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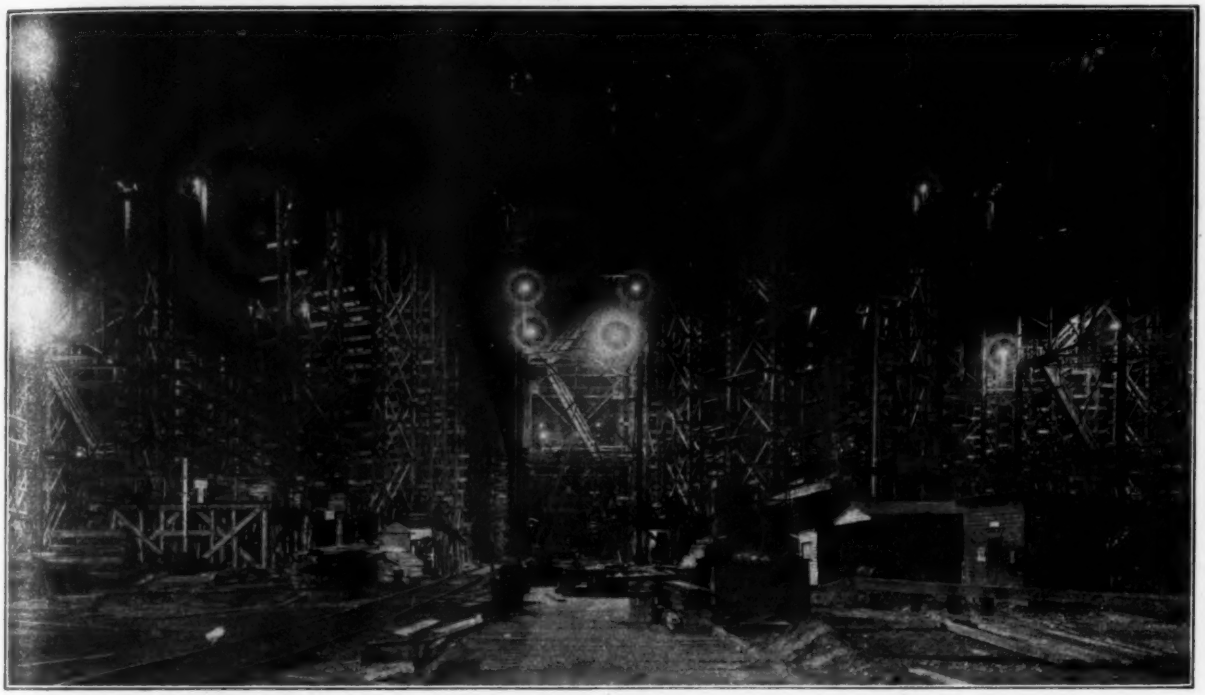


Typical Night Lighting of Shipways at Hog Island Shipyard. Photograph Taken at 11 P. M.

Electrical Distribution System at Hog Island Shipyard

Extensive Distributing System for Power and Lighting at World's Biggest Shipyard—Circuits Largely Underground—Connected Load of 30,000 kw. Power and 6000 kw. Lighting

By H. W. YOUNG

During this year several articles have appeared in the ELECTRICAL REVIEW, notably in the issues of Feb. 16 and Aug. 3, 1918, describing activities at the world's greatest shipyard on Hog Island, near Philadelphia. Through the courtesy of William H. Blood, Jr., of Stone & Webster, or more properly, the American International Shipbuilding Corporation, for he is now located at Philadelphia, and also of H. W. Osgood, electrical engineer of the electrical fabrication department, and R. R. Wisner, plant electrical engineer at Hog Island, it is possible now to present latest information concerning the very elaborate electrical distribution system at these gigantic yards.

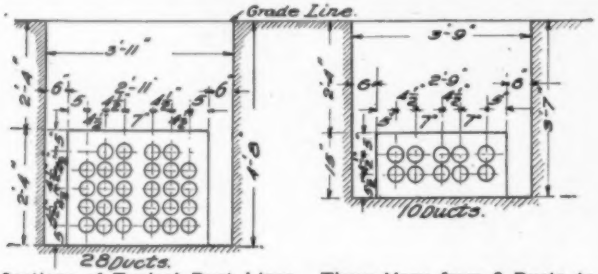
This system is very largely underground, through concrete-protected fiber conduit. All around the shipways themselves and the maze of tracks serving them there is constant movement of derricks and locomotive cranes which would seriously interfere with overhead wires. Farther back from the waterfront, around the administrative quarters, there is plenty of overhead work, however.

The current supply, as previously noted, is obtained from the Philadelphia Electric Co., at 66,000 volts, which is stepped down at a main substation to 4100 volts, 3-phase, 4-wire, and distributed largely underground, using 3-conductor, lead-covered, paper-insulated cables and a grounded, noninsulated neutral. This plan was adopted in order to use standard 2400-volt distributing transformers connected between one leg of the system and the grounded neutral.

Orangeburg fiber conduit is used throughout, of the Harrington joint type. It is 3½-in. size and is

incased in concrete, 3 in. thick at top, bottom and sides. The manholes are all of poured concrete with concrete floors and roofs and having cast-iron, nonventilated covers. The manhole walls and floors are 9 in. thick; the roof is reinforced with ¾-in. rods. All manholes are drained to adjoining sewers.

A portion of the conduit line required but little excavation, the original grade being several feet below the finished grade of the yard. Each conduit run was sloped slightly toward the manholes, the top of the conduits being 2 ft. 4 in. below established grade at



Sections of Typical Duct Lines. These Vary from 2 Ducts to 28 Ducts.

the manholes and 2 ft. below grade midway between manholes, this 4-in. slope providing for drainage of the ducts. Details of some of the duct sections and of typical manholes are shown in accompanying engravings, as also a general idea of the method of construction used.

In general, the distribution along the shipways is divided up into five districts. Each of these districts, embracing 10 ways, is served from a compressor house for both air and electric service. Although all ways are connected on one main, each compressor house has two regular 4000-volt feeders and one common emergency feeder, which latter is also used for starting the compressors.

Each group of 10 ways is supplied with power from the compressor house in that group by a 4000-volt feeder that runs to five transformer houses, one house to each two ways, near the head end. This feeder system is also run through conduit in the manner above described. The laterals between the transformer houses on the ways are run in iron conduit, as these houses are about 200 ft. apart, and the conduit loops between houses.

A bank of transformers in each house steps the voltage down to 440 volts, three-phase for derrick power and miscellaneous portable motors. Conduit from the transformers to the ways is iron on account of the difficulty of using fiber in a number of places where it could not be supported on the ways.

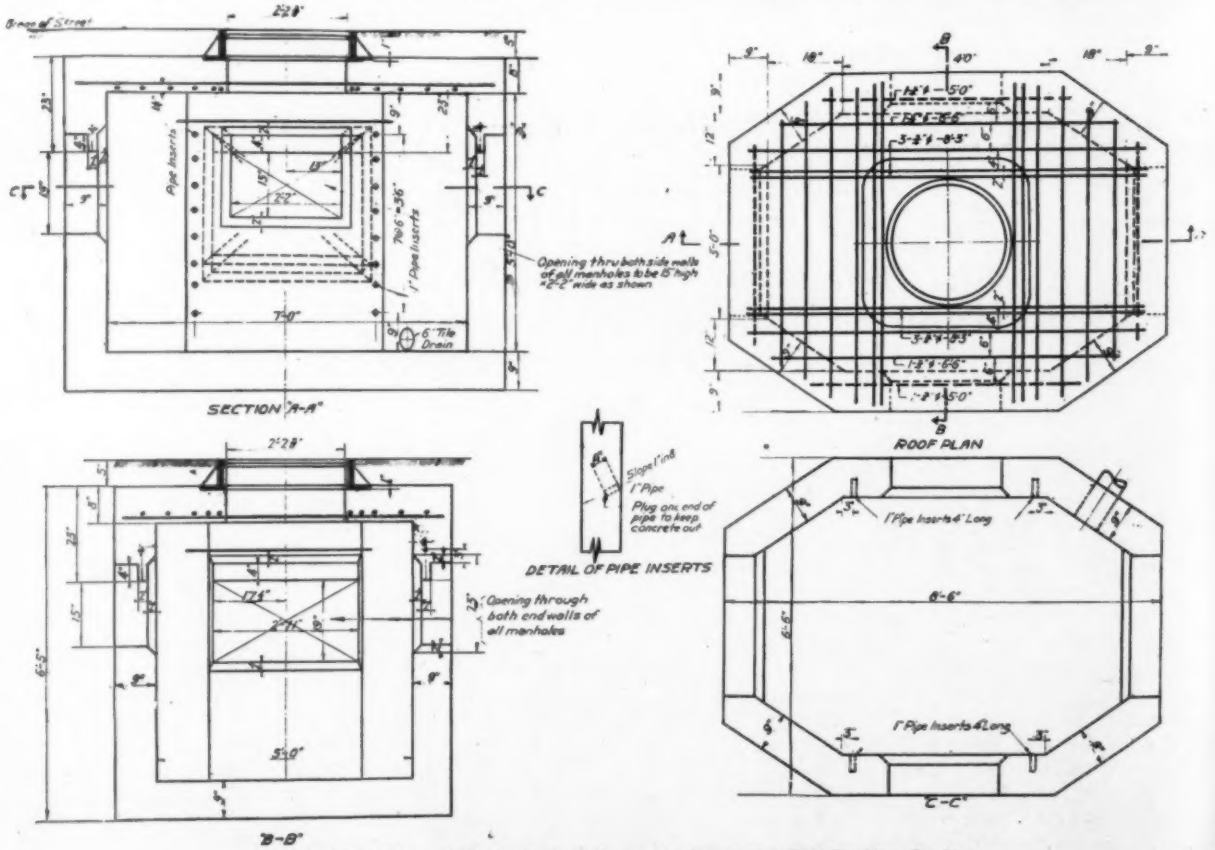
Lighting on the ways is all taken care of by three feeders, two feeders supplying two groups of 10 ways each and one feeder one group of 10 ways.

Power for the wet basins, where the ships are taken for final fitting out, is supplied by two feeders with a center of distribution for each of two compressor houses, in the same manner as at the ways. Three wet-basin piers are connected to one compressor house and four to the others.

These compressor houses are served by two power feeders and each wet-basin pier has also a transformer house to step down to 440 volts, three-phase for power and 220-110 volts, three-wire, single phase for lighting.

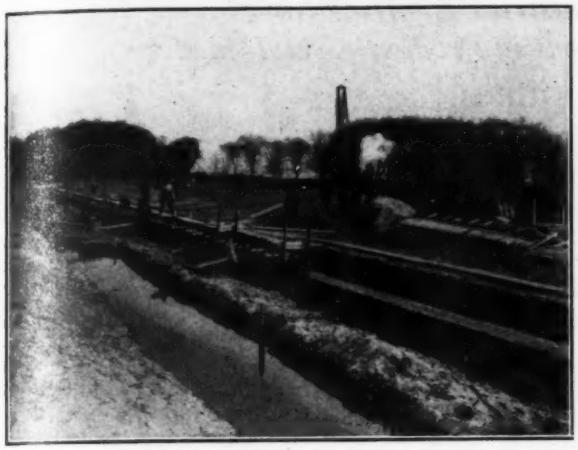
The shops are supplied with light and power by separate feeders, all carried underground. Likewise, the various administration buildings are served by district lighting feeders.

General yard and street illumination is accom-


SECTION "A-A"
Opening thru both side walls of all manholes to be 6' high x 2'-2" wide as shown
ROOF PLAN
DETAIL OF PIPE INSERTS
Slope 1" in 8
1" Pipe
Plug on end of pipe to keep concrete out
Opening through both end walls of all manholes
1" Pipe Inserts 4' Long
B-B
C-C

Plan and Sections of Typical Manhole on Underground Distribution System.

plished with General Electric Novalux fixtures containing two or four 1000-watt nitrogen-filled Mazda lamps. These have a clear globe, ventilated canopy, suitable receptacle and prismatic-band refractor. In general, these lights are placed about 57 ft. from the



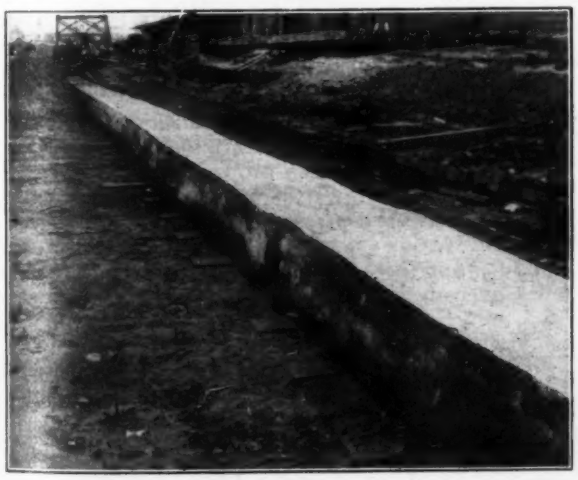
Sewer and Water Department Trench, and Laying Electric Conduit Line.

ground on poles spaced approximately 500 ft. apart each way. There are about 700 of these units altogether. Street-lighting poles are served with a single-phase primary and a step-down transformer on each pole.

A considerable number of the street-lighting feeders in the yards are run as lead-covered cables through pump-log conduit suitably protected by planking. Also, as before stated, distribution at points removed from the ways is to some extent overhead.

An idea of the magnitude of the electrical installation is obtained from the following facts:

The total connected power load is about 30,000



Main Duct Line to the Wet-Basin Section, Hog Island.

kw.: the total connected lighting load is about 6000 kw.

Primary power and light distribution for buildings comprises the following: For the underground system, concrete duct line with fiber conduit, 25,000 ft.; 150,000 duct ft.; 60 manholes; iron conduit, 20,000 ft. Cable:

3-conductor, 5000-volt, No. 0000.....90,000 ft.
3-conductor, 5000-volt, No. 0.....10,000 ft.
3-conductor, 5000-volt, No. 6.....15,000 ft.
Single-conductor for neutral, No. 0000.....30,000 ft.
Single-conductor for neutral, No. 0.....10,000 ft.
Single-conductor for neutral, No. 6..... 7,000 ft.

For yard and street lighting there is the following: For underground system, 35,000 ft. pump log; cable: 3-conductor, lead-covered, No. 6.....25,000 ft.
1-conductor, lead-covered, No. 6.....30,000 ft.
1-conductor, for neutral, No. 6.....45,000 ft.

For yard and street lighting the overhead cable totals 70,000 ft. of No. 6 weatherproof.

The total overhead distribution in the shipyard aggregates about 25 miles.

WHAT IS AN ENGINEER?

New Definition to Clarify Public Misconceptions Issued by Director of Engineering, U. S. Employment Service.

Especially interesting, from the standpoint of the war, is the publication of a new definition of the engineer which has been written by A. H. Krom, director of engineering, United States Employment Service, Chicago. The definition comes as the result of the many queries that have originated through a confusion of engineering terms and standards now in general use. After serious study and consultation with eminent authorities, Mr. Krom prepared the following definition:

"An engineer is one who economically directs man power and, by scientific design, utilizes the forces and materials of nature for the benefit of mankind."

In writing this definition, Mr. Krom hopes to offer a practical, workable statement that will be of real value to technical men and to employers of technical men. The definition will doubtless be useful in clarifying popular misconceptions. Students of engineering and prominent scientific authorities declare that Mr. Krom's definition is representative of the highest engineering ideals and that it covers all classes of engineering. In view of the importance of the engineer in the present war, it is highly important that his status be properly defined.

WOMEN NOW EMPLOYED AS ELECTRICAL WELDERS.

Another advantage of electric welding over riveting in the building of ships was brought out recently when it was shown at the big Hog Island shipyard that women can become efficient electric welders. This means that the adopting of electric welding done by women on many of the smaller parts of ships will do much to settle the labor-shortage problem. The women so far employed are proving very efficient and are enthusiastic over their work, and there is no apparent reason why they should not, with the proper training, supplant men in welding many of the minor parts.

In nearly every line of work where women have been employed to relieve the labor shortage they have proven themselves as careful and painstaking as men. As successful welding is largely dependent upon the careful manner in which it is done, they should prove successful in this line also.

The instruction of the women and men welders is now being carried on by the instructors returned to the various plants after completing the training course of the Education and Training section of the Emergency Fleet Corporation. These men have been given several weeks' training and instruction in the schools organized by this section and have given very valuable service in the teaching of others.

Productive Lighting Intensities

Paper Before Convention of Illuminating Engineering Society Gives Results of Industrial Lighting Survey—Average Increase of 15 per cent in Production Obtained

By WM. A. DURGIN

Lighting Assistant to Vice-President, Commonwealth Edison Co., Chicago.

From the tumult of conflicting and sometimes almost frenzied cries that food will win the war, or that ships, or Liberty Bonds, or the irresistible surge of the Yanks are the ultimate factors, it has gradually become clear that each of these is but a partial statement of the truth, that the war is to be won by essentials, and may yet be lost by nonessentials.

Coincident with this clearing of the fundamental question has been a stiffening of individual determination until every true American is fired by the burning desire to make himself essential. Many have been able to accept the simple and final solution of this desire by enlistment. Others, kept at home by noncombatant mouths which must be fed or by physical incapacities which cannot be ignored, are still held to the daily routine of business, and have used their best imagination to so apply their especial skill and knowledge as to make their little activities a vital factor in the complete and lasting defeat of the cruel madness of the Hun.

This spirit, the finding and perfecting of the essential application, has been marked among lighting men. The reports of the Society's contributions through its committees to particular lighting problems are, I believe, typical of the spirit of the industry. But only a comparatively small number of men can give valuable aid in such special research work, while several army divisions of those concerned in the production of lighting equipment, in the central-station supply of energy, and in the effective application of light, have chafed and fretted for real opportunity. Looking to our several Government bureaus for direction, we have indeed found some ways in which to help. The wise and complete program for elimination of waste in lighting has secured our whole-hearted support. The educational use of the reaction of lightless nights has stirred some satisfaction in its implied acknowledgment of the value of lighting in producing desired mental states.

But the war-winning effect of all these measures after all seems a bit remote to the man filled with the fighting spirit. He wants direct action, he wants to apply light to war and, after careful survey of the field, he naturally turns to the production of war material as his real opportunity. How can light be used to make faster ships, more deadly shells, safer gas masks, sharper bayonets, and especially how can light help to produce these at once, while the spirit of victory is with us? Obviously this is no time for hair-splitting, but for prompt, definite, effective work. The question is not: What form of lighting installation will give the most perfect manufacturing results? That sort of problem has occupied our society for some dozen years, and as I hope to convince you the result upon average practice has been hardly epochal. Our problem is rather: How can we alter existing equipment, quickly, at small expense, to secure a real economic war benefit to our country?

The beneficial effects of lighting in its industrial application have never been stated more clearly than in Professor Clewell's analysis published some six years ago. "Good lighting," he says, "increases production, improves accuracy, decreases accidents, removes eye-strain, makes general surroundings more cheerful, adds to the comfort of the workers, results in better order and improved neatness, and conduces to effective supervision." These claims every man believes who has had opportunity to observe the results of improved lighting. Indeed, there is now a semi-official backing, for if lightless nights have sobered us, surely improved lighting may be expected to spur us on. But improved lighting has been before the country for nearly ten years, and it would seem that is time enough to have secured realization of the truth if that truth has any large economic value, unless, perchance, it has not been properly presented.

In the crisis of war, from the viewpoint of the manufacturer, hard pressed to meet Government contracts, Professor Clewell's eight heads reduce to one: *Good lighting increases production.* For with omnipotent Government inspectors enforcing necessarily strict tests, improved accuracy means a greater proportion

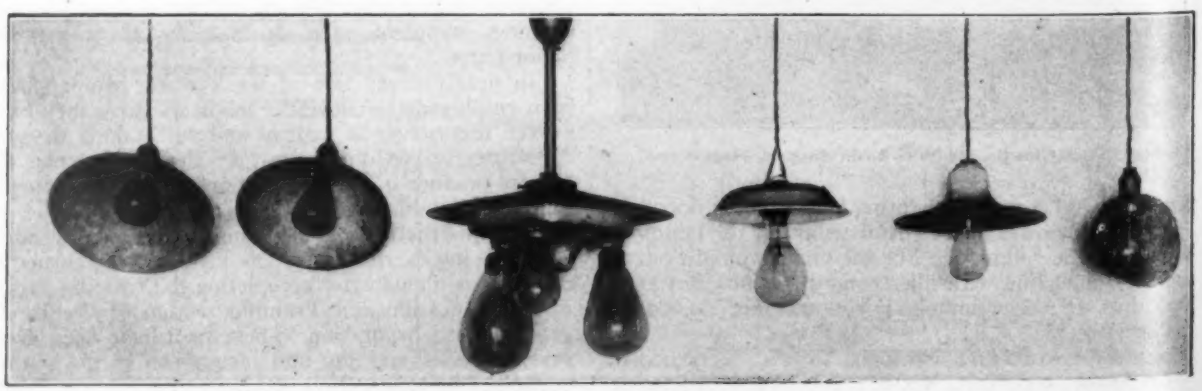


Fig. 1.—Typical Lighting Units Now in Use in the Larger Number of Industrial Installations.

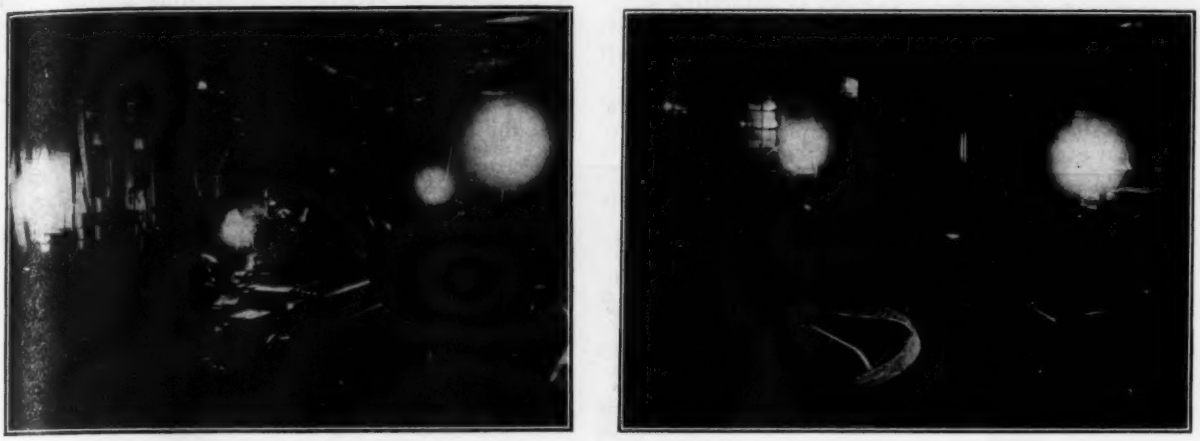


Fig. 2.—Two Typical Examples of Lighting Produced by Such Units as Shown in Fig. 1.

of output accepted. Decreased accidents mean less time lost, fewer men leaving for other work; decreased eye strain, better product, longer production hours; cheerful surroundings and increased comfort, retention of a full force of men; order and neatness, quicker and better execution; and more effective supervision, the elimination of mistakes, and especially of long unproductive conversations on the pleasurable expenditure of enormously increased pay.

For war, then, we claim that good lighting increases production and we have three questions before us:

1. Are the war plants well lighted now?
2. Is our claim of increased production really important?—and, if so,
3. How can we apply our knowledge quickly, cheaply, effectively?

In attempting to answer these questions in Chicago, we have considered ourselves most fortunate in having a fairly definite criterion for good lighting as established in the latest revision of the I. E. S. Factory Lighting Code. This, with the several published commentaries and the Wisconsin modifications, emphasizes principally a sufficient intensity of light in the working spaces and efficient accessories, such as will reduce brightness contrasts to an acceptable degree. While the formulation of the latter requirement is still disappointing in its indefiniteness, it at least gives some basis for judgment, and a slight experience with existing plants shows it so far in advance of average practice as to be quite sufficient for our immediate need.

Industrial Lighting Survey Undertaken in Chicago.

With three engineers carefully instructed in these intensity and brightness standards, we have undertaken an illumination survey of every industrial plant using central-station service in Chicago which has a connected load of 100 kw. or more. At present, there are 663 such plants, of which we have surveyed 93. To be sure, these are not all war industries, but a surprisingly large part are doing at least some war work, and there is no easy way of grouping the customers without a visit to the plant, when it is almost as simple to continue the investigation and obtain complete data.

The 93 plants thus far surveyed total 17,400 employes, cover a floor area of 96 acres, and aggregate a lighting load of 1420 kw. While the survey is largely inspectional, listing the number, style and condition of units used, and applying arbitrary utilization factors to obtain the intensities produced, very considerable confidence is felt in the average results, which show a mean of 1½ foot-candles now in use with variations from 0.01 to 10 ft.-cdl., and an average consumption of 0.33 watt per sq. ft. and 80 watts per employe. For these same plants, the I. E. S. code would provide an average intensity of 5.5 ft.-cdls., 3.66 times the present level. The intensity would vary from 2 to 12 ft.-cdl.; the average watts per sq. ft. would be 1, and the watts per employe 240, or 3 times the present consumption.

This showing of the extreme inadequacy of intensity, judged even by the conservative I. E. S. standard, when our industries should be working at their maximum production or not at all, seems striking enough, but when the element of proper shading is considered, the opportunity of the lighting man becomes unquestionable.

The average of 1½ ft.-cdl. is produced principally by units shown in Fig. 1. These are not historical exhibits of the beginning of industrial lighting, but actual typical examples taken from large factory installations in exchange for new equipment last week. Similarly, Fig. 2 is not of Edison's early installations, but of conditions in two large plants just a few months ago. If our contention that good lighting increases production is true, here is a field second to none in its demand for Government enforcement of true conservation measures, but is our claim true? Again we have attempted to secure unbiased engineering data. As our engineers in making the lighting survey approach the plant superintendent without attempt to sell lighting or to introduce any commercial argument, but simply to secure the actual facts of his present installation, so we have endeavored to make unbiased engineering tests in representative plants to show the actual effect on production of increasing intensity and decreasing glare.

Such tests are much more difficult than at first thought appears. Our revised program contemplates a four-month run, the first month with the equipment as it exists; the second with proper equipment to give 50 per cent higher intensity than the maximum recommended by our code; the third month at the lower code level for ordinary practice, or what is generally considered good present practice; and the fourth again at the higher or productive-intensity level. For such a test, the plant production records must be accurately kept and a fair percentage of the work must be done in hours of darkness. The chief difficulties are two: (1) To find plants with adequate

production-record systems, and (2) to induce the plant to return to the lower level of intensity at the end of the second month of the run after the advantage of good lighting has been once experienced.

Thus far we have sold the productive-intensity idea and necessary equipment to eleven plants. From two of these we have secured reliable data. The first has already been noted briefly in Mr. Millar's paper on "Lighting Curtailment." The test was run in a machine shop producing soft metal bearings, operations ranging from rough to fine. Only two months of the program were run, but in the month during which the intensity was maintained at 12 ft.-cdl., production in the several operations was increased from 8 per cent to 27 per cent over that of the previous month when an intensity of 4 ft.-cdl. was used. In this instance general lighting with deep bowl reflector equipment was employed for both intensities and every precaution taken to eliminate commercial bias. The superintendent was so impressed with the value of the higher intensity that he had it extended to the other floors of the building. In the second accurate test, the program could not be followed carefully, the comparison being between bare lamps on drop cords and a properly designed reflecto-cap installation. The new equipment gave about 25 times the intensity previously used, and showed an increased production of from 30 per cent to 100 per cent in the several operations of a large pulley machine shop. Again, the superintendent was enthusiastic. In the other nine plants it has been impracticable to run tests, but in every case the superintendents and owners are fully convinced of the truth of our statement that the average effect will prove at least a 15 per cent increase in production at an increased cost of not more than 5 per cent of the payroll.

The investigation which perforce was allowed to lapse upon the entrance of our country into the war has been renewed with increased earnestness as it was realized that here lay the great opportunity for central-station lighting business to serve.

We have three further test installations now under way, and every plant surveyed is canvassed as a prospect for such test. We purpose to include at least 10 industries of as widely varying character as possible, bearing the expense of the trial equipment with the understanding that, if the owner is convinced of its value, he will purchase after the test at our regular prices. But we feel that the data already at hand, as supported by experience of lighting and industrial men in many cities, are sufficient to warrant the acceptance of the proposition. There has been not the slightest indication in the figures thus far that our claims are optimistic. On the contrary, it appears that the effect of sufficient light as a real productive element is a much greater economic advantage than we have appreciated. The need is pressing, and we cannot wait for complete proof; rather, as in all war questions, we must accept that which is probably true, and pursue the chosen path vigorously and fearlessly.

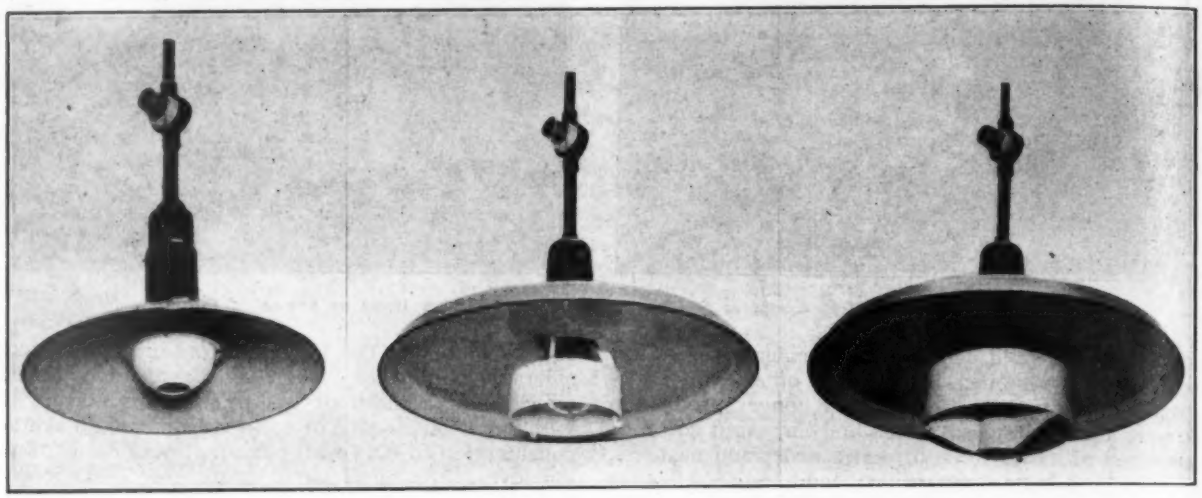


Fig. 3.—Eye-Shield Units for Wide Spacings Giving Productive Intensities With 200, 300 and 500-Watt "C" Lamps, Respectively.

For the period of the war good lighting in factories must become our principal objective, and to secure it we must be content with passable rather than perfect embodiment of the principles we have established. To get results quickly, it is impracticable to secure the absolutely best equipment for each installation. In our own company, therefore, we have adopted definite specifications employing three general types of equipment:

(1) Gas-filled lamps with steel reflectors and eye-shields in the 200, 300, and 500-watt sizes.

(2) Gas-filled lamps with deep bowl reflectors for extreme mounting heights.

(3) Vacuum lamps and deep bowl reflectors for certain drop-cord applications.

Our effort is concentrated upon the first class, examples of which are shown in Fig. 3. In using these eye-shield units, it is of first importance that the shields be sealed in place and only removable by the foreman or other authorized employe, for the ordinary workman believes but one part of the code. He wants more light, but he knows nothing of the effect of excessive brightness contrasts, and if left to himself will remove the shield as a useless obstruction. Recent installations of all three units are equipped with such sealing wires.

Of the three, we are especially emphasizing the 300-watt unit. It has an efficiency of some 84 per cent, a maximum brightness of 7500 millilamberts on the interior of the diffuser ring, and is well adapted to installation on present outlets. This we feel is a particularly important consideration for the war drive. In many plants it is hardly possible to rewire now; in others it is very questionable whether such rewiring is warranted. But with this unit giving its maximum candlepower at the 50° angle, it is entirely prac-

ticable to produce reasonably uniform lighting with spacings of 14 to 16 ft. at mounting heights from 10 to 16 ft.

Where 12 to 18-ft. mounting heights above the floor are possible, spacings as high as 20 ft. can be used with the 500-watt unit, with an acceptable result in uniformity of intensity and diffusion of light. This unit has an efficiency of 77 per cent and a maximum brightness of 2300 millilamberts, view of the interior of the ring being largely cut off by the blades. The comparison between this approximation and the ideal is shown in Fig. 4. The 200-watt reflecto-cap units are on 10-ft. spacings—the 300-watt units on 16-ft. spacings at about the same mounting height with remarkable resultant uniformity. Again it may be emphasized that our object is not ideal illuminating engineering; it is practical application with as little change in wiring as possible to the end that transporting and protective fighting equipment may be produced with the speed which characterizes the advance of our victorious army. In these installations we are to secure productive intensity quickly at minimum expense with equipment which will continue to supply that intensity during its life.

Of primary importance, therefore, is the ease with which such equipment can be maintained. With the drop-cord units of Fig. 1, bare or shaded by the tin dirt collector, even the extremely serious defects in intensity produced and brightness contrasts permitted are hardly as important as the extreme inefficiency which results after the machine has spattered them with oil, or the workman has manipulated them with dirty hands. We have tested several such units taken directly from factories, and have found the utilization efficiency less than 25 per cent. Now if coal saving through lighting is important, surely the maintained efficiency of large sources which can be reached only by regular maintenance men is worth our Government's consideration. Maintenance of the lighting equipment in war work on a regular schedule should be made a part of the Government's mandatory supervision. It is best done by employes of the plant affected, but pending the Government's action, we are endeavoring to maintain factory installations in Chicago at cost, using our own men and visiting each plant at least monthly.

Surely the argument thus briefly summarized is valid from the manufacturer's viewpoint. With cold weather approaching and fuel none too plentiful, there is, however, another viewpoint from which productive intensities must be considered. Admitting that output is increased at a negligible expense to the plant concerned, what is the effect on coal consumption? Productive intensity in general will mean three times the present consumption of electrical energy in industrial lighting. If output is increased 15 per cent, is that consumption warranted? For the 93 factories previously considered, the total consumption per month is 4,826,000 kw-hrs.; of this 203,000, or 4 per cent, is used for lighting. To secure our productive-intensity level would require a consumption of 640,000 kw-hr., 13 per cent of the present total or a 9 per cent increase in fuel consumption. An increase of 15 per cent output for 9 per cent fuel is worth while in itself and will certainly appeal to the Fuel Administration. But when it is remembered that without that 15 per cent only 85 per cent of the possible maximum fighting equipment will be in the hands of our boys for the final drive next spring, that without that 15 per cent output perhaps 15 per cent more lives of American youths must be sacrificed, the immediate realization of productive intensity throughout our industries becomes the essential service of the lighting men.

Fig. 4.—Productive-Intensity Lighting in Plants Shown in Fig. 2. Left Figure Using 200-Watt Reflecto-Cap Units, and Right Figure Using 300-Watt Eye-Shield Units.

SCHOOL LIGHTING IN CHICAGO FOUND DEFICIENT.

At the request of one of the trustees of the Board of Education of the city of Chicago, an investigation of the lighting conditions and illuminating systems has been made in typical schools by Otto H. Mohr, an illuminating engineer of the Federal Government. He found that artificial illumination of Chicago's public schools is not only poor and archaic but wasteful in the material used and in the electricity and gas it requires. "In the first place not every school building in Chicago is equipped with an illuminating system, certainly a surprise in these days when the use of school buildings and classes by people in the evenings is becoming general," said Mr. Mohr. "Where there are illuminating systems there has been no lack of expenditure of money. There has, however, been a complete lack of illumination upon a modern, scientific and truly useful basis."

These conditions are typical of what may be found in the majority of schools of the country today to the great injury of the eyesight of millions of children just when they should be taught to protect the eyes by proper illumination.

Linking Science and Art in Lighting

Second of Six Articles Discussing Extensive Opportunities in Esthetical Lighting, a Field That Has Been Little Developed Even Though It Represents Half of the Lighting Business

By M. LUCKIESH

Nela Research Laboratory, National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio.

PART II.—GENERAL DISCUSSION OF THE EXPRESSIVENESS OF LIGHT.

In order to do justice to the potentiality of light and to be able to handle light with ease in attempting to develop its psychological or esthetical possibilities, it should be considered quite similar to pigment or other media employed by the decorator. The expressiveness of light arises through its *effects* upon the appearance of objects, surfaces, and upon an interior as a whole. In viewing lighting from the present standpoint we are sometimes concerned with the lighting units but not generally. A decorative bracket or portable lamp should be artistic when lighted or unlighted and if so it is usually easy to look at when lighted. Such units are conspicuous objects in a room and for this reason both of the foregoing requirements must be fulfilled.

But our impressions of the lighting of rooms are formed, more or less unconsciously it is true, by the distribution of brightness and color about the surfaces of the room and by the character of the shadows. Harsh shadows are not generally pleasing and we associate with them glaring light-sources and a lack of diffusion of light.

A decorator develops a scheme for a given room which he feels is appropriate and which aims to create a certain mood in the room. This mood or expression is fixed only insofar as the lighting does not modify it. The brightness of the walls of a room bear a certain relation to that of the ceiling for two reasons, namely, the reflection-factors of their respective coverings and the intensities of illumination which they respectively receive. The decorator fixes the first relationship when he chooses the coverings but, unless he controls the lighting and fixes it according to the requirements of his scheme, he may find that the lighting has interfered with his plan.

*The first article in this series was published in the ELECTRICAL REVIEW of Oct. 5, 1918, pages 532-534.

Fig. 1.—A Living Room in the Subdued Light From a Single Direct Light-Source.

INFLUENCE OF LIGHTING UPON DECORATIVE SCHEMES.

In fact, no decorative scheme appears the same under daylight illumination as it does under artificial lighting because the distribution of light generally differs very much for the two cases. Add to this influence that due to the difference in quality or color of the two illuminants, and we are not surprised to find quite different expressions by day and by night in a given room. It does not appear necessary to go elaborately into the details relating lighting and decoration, but suffice it to state that there are many indications that decorators in general do not appreciate fully the intimacy between these two, that is, the influence of lighting upon decoration.

Fig. 2.—The Same Living Room With Combined Direct and Indirect Light, Showing the Striking Contrast Produced by This Changed Lighting.

Lighting has more or less influence upon decorative schemes depending on the individual conditions. For example, if a room is done completely in one shade of gray (to take a simple case) the relative brightnesses of walls and ceiling are entirely dependent upon the relative intensities of illumination which these areas receive. Similarly, the tints of the various areas will be those of the light reaching them. In this case any radical change in the distribution of light will result in an apparent change in the decorative scheme or, in other words, such a room is very sensitive to lighting.

In a case where, for example, the wall coverings

possess a reflection-factor very much smaller than that of the ceiling, the decorative scheme is safer from disturbance by alterations in the distribution of light. Different kinds of ordinary lighting systems, though differing radically in respect to distribution of light, would not alter the mood or expression of such a room nearly as decisively as they would in cases where the rooms approximated that described in the previous case. However, all rooms are subjected to conspicuous changes in expression with changes in the lighting system or, more specifically, in distribution of light.

It has been the object of the preceding paragraphs to emphasize the expressiveness or decorative possibilities of light. The latter does not refer to the lighting units, as is generally implied in the common usage of this phrase, but to the effects of light upon the objects, walls, and the interior as a whole. This phase of lighting should be more generally recognized and those engaged in lighting who aspire to become lighting artists should study this aspect extensively. Incidentally there is a need for another term to distinguish illuminating engineers from those who are more particularly expert in the esthetical or psychological phases of lighting. It appears that the term "lighting artist" fills this need very well. When an individual masters both these phases he might assume the title "lighting expert."

Wide Range of Possibilities in Changing Lighting Effects.

If one becomes convinced that light may be handled in quite the same manner as pigments or other coloring media, doubtless he would next look about him to ascertain the limitations imposed upon this theoretically unlimited field by fixtures and other practical considerations. In fact, the means for controlling light, the variety of lamp sizes, the various simple expedients for obtaining tinted light, the many locations for concealing or exposing lamps, and the unlimited artistic touches which may be employed to clothe the purely utilitarian mechanisms, etc., provide a range of possibilities sufficient to satisfy the lighting artist for some time to come. Not only may the fixtures be decorative and correct in style, but their purely utilitarian parts may be designed to distribute and to tint the light as desired.

The charm of mystery may be utilized by one of a multitude of schemes for concealing the light-sources. In some cases where the lighting units are totally concealed behind architectural details, such as cornices, capitals, and other recesses which have been specially provided, this aspect of mystery is most prominent. In other cases the sources may be concealed in what are obviously lighting units but mystery is still mildly present. We need not limit ourselves to the generally common types of fixtures for, as has already been exemplified in many beautiful installations, flower boxes, urns and other ornamental objects uncommonly associated with lighting may be pressed into service with appropriate and pleasing results. Even with common fixtures, a tremendous range of effects is obtainable. The illuminating engineer who ignores this esthetical or, more broadly, the psychological aspect of lighting, will not evolve into the lighting expert and will not do all that he could do toward the utilization of the possibilities of lighting.

Lighting can aid materially in expressing certain ideas, in arousing emotion and sentiment, and eventually will be utilized more definitely and forcefully in this manner. Bearing witness to these possibilities are some of the already wonderful attainments in the new movement in the theater. On combining with all these phases the symbolic aspect of color, which has been slowly evolving since the beginning of man, we are almost ready to state that light and life are synonymous.

Owing to the extreme limitations of photography for recording or reproducing lighting effects as the eye sees them it is impossible by means of photographic illustrations and half-tones to do more than to suggest the expressiveness of light. It is necessary, owing to the impracticability of reproducing color effects in an article of this character, to leave entirely to the imagination the charm of tinted light and, therefore, it is almost a hopeless task to convey to the reader more than a vague idea of this aspect of lighting. After a few general paragraphs and inadequate illustrations it will be left to the reader to reason and to observe. The best illustrations would be obtained in a representative interior lighted in many different ways, but such photographs are not available at present so a few illustrations have been selected in which, more or less definitely, the expressive or decorative value of light is shown.

Influence of Lighting in Creating Different Moods.

That light is a powerful influence in creating, or at least in helping to create, various moods in a room may be easily determined by observation and experimentation. In the simple cases shown in Figs. 1 and 2 this phase is suggested. In the first we have the effect produced by the direct light of a table lamp. This provides an oasis of light amid semi-darkness—a delightful spot for reading and a restful environment after the day's activities. In Fig. 2 the effect is produced by a combination of direct and indirect light—an expression quite different from that shown in Fig. 1. Here are two effects quite different in character which help to relieve the usual monotony of lighting and make it possible to suit the lighting to the mood of the occupants or to the spirit of the occasion. It has been said that the home is the theater of life; if so, is it not appropriate that we aim to supply a sufficient variety of effects to help in the various settings—gaiety, quietude, repose and various occasions?

In the home many objects combining utility and beauty are grouped. Symmetry is not ordinarily a

Fig. 3.—A Bank Interior Showing How Lighting Skillfully Applied Can Produce Controllable Decorative Effects Not Obtainable by Day.

dominant note. Spots of light here and there with sometimes a flood of light are our chief requirements. However, in our large "architectural" interiors, such as churches and other public buildings, lighting approaches more closely in its possibilities to those of pigments and other media of the decorator. That artificial lighting has such an aspect is shown in Fig. 3. Here it produces effects in "painting" various areas far more satisfactory than those produced by daylight because it is controllable. Doubtless this controllability under the guidance of the decorator may result in effects undreamed of before the advent of convenient artificial illuminants. The architectural details are modelled delicately with a symmetry of light and shade that is desirable but unattainable usually with natural light. In fact, under appropriately distributed light it is likely that the final result more nearly approaches the mental picture which the architect had visualized than the results ordinarily obtained with daylight.

The modelling of the archways, the beautiful patterns in light and shade, and the flaming touches in Fig. 4 lend further aid in emphasizing the expressive value of light. Not only may the character of an institution be indicated in lighting effects, but the latter may possess a deeper meaning. For example, in churches the lighting may not only be dignified and "ecclesiastical" but, owing to its variety of effects, one may be chosen which fits the spirit of the creed or, at least, the dominant note of the creed. Compare Fig. 5 with the preceding illustration and we may imagine the range of possibilities.

We must rest the case at present with these brief discussions and the illustrations which are quite inadequate owing to the limitations of photography for recording the wonderful possibilities of light. It is hoped that at least the reader is sufficiently convinced of the expressiveness of light to extend his view in this respect by further study and observation. In this field of lighting we need more lighting artists. It is possible for the illuminating engineer to cultivate an artistic sensibility and he must do so or step aside for the artists who will enter the field. Throughout the whole esthetical aspect of lighting the chief need is for correlating science and art. The engineer is doing the engineering of lighting well. The artist possesses the finer sensibility for introducing the artistic into lighting. But each working alone cannot do justice to the possibilities of lighting. We must bring these two talents together.

(To be continued.)

Fig. 4.—Indirect and Direct Lighting of a Cathedral, Showing the Expressive Value of Light.

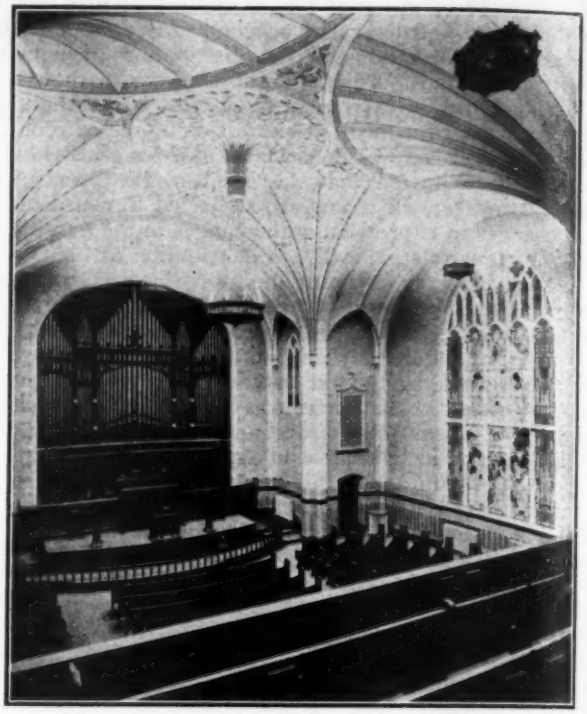


Fig. 5.—Pure Indirect Lighting in Another Church, Showing How a Totally Different Effect Can be Produced by Change of Lighting. Compare With Fig. 4.

NUT SHELLS NEEDED AS WAR MATERIAL.

Carbon Obtained from Them Used in Making Gas Masks.

The Gas Defense Division of the Chemical Warfare Service has sent out a special request that the crops of hickory nuts, walnuts, butter nuts, etc., be gathered as fully as possible this year and the shells saved for making gas masks. A large part of this crop goes to waste every year. This year, however, an earnest attempt is being made to save as much of the crop as possible owing to the urgent need for the shells. This has already resulted in the formation of many nut-gathering clubs in the communities where nuts abound.

The carbon which is made from nut shells has been found to be the only acceptable filter for use in gas masks. Wood-carbon and other forms of carbon will not do as they have a tendency to jam or pack, thus allowing the gas to escape. As has been stated, the need for this carbon is very urgent. To equip the proposed army of 4,000,000 with proper gas masks will require 28,000,000 lb. of nut shells. Until an adequate supply of raw material is received from the Philippines and the East Indies, this carbon must be furnished by nut shells turned in by patriotic citizens. The shells are acceptable in any condition.

Editorial Comment

Good Results From Chicago Industrial Lighting Survey

ANY general inspection of factories in almost any industry shows that, in spite of the rapid progress in the lighting art of the last dozen years or so, the lighting conditions still prevailing in the great majority of industrial plants are very unsatisfactory. Although there have been repeated efforts to interest plant owners, managers and superintendents in the importance of good factory lighting, from the standpoint of actual results the surface has only been scratched. Consequently there is unlimited room for further constructive propaganda and especially arguments and data that will apply to specific industries. It is to help supply these that the ELECTRICAL REVIEW has for several months published articles on the value of improved lighting to different industries.

Most lighting men realize that there never was a time when a campaign for better factory lighting would bring more valuable results to the nation—knowing what a beneficial effect improved lighting has on production, on quality of output, on the working conditions and general efficiency of employes, increased efforts are being made to disseminate this information among manufacturers so that the production of war supplies may be facilitated as much as possible. Probably nowhere in the country have these efforts been more persistent and more successful in securing definite results than in Chicago. A general summary of these results was presented in a paper by Mr. Wm. A. Durgin read before the recent New York convention of the Illuminating Engineering Society, and on account of its importance we are reproducing it on other pages of this issue.

The Chicago lighting survey has been confined to the larger plants, those having a total connected electrical load (power and lighting) of 100 kw. or over. About one-seventh of these plants have been surveyed and in the nearly 100 plants so inspected an average of about 1½ foot-candles was found as the general mean of illumination intensities, or less than one-third what in the light of present knowledge would be regarded as a fairly adequate mean value. The variation in intensity observed ranged from 0.01 to 10 ft.-cdl. Since the plants so far surveyed were the larger ones, each plant averaging 187 employes, and it is well known that smaller factories almost invariably have much poorer lighting, the results reported by Mr. Durgin are a striking verification of the backwardness as to industrial lighting of even those factories in a big industrial city that one would expect to be the most enterprising.

Mr. Durgin refers briefly to special tests made in two Chicago plants to determine the production increase following rehabilitation of the lighting installation. In one of these plants trebling of the intensity resulted in output increases ranging from 8 to 27 per cent for different operations, whereas in the other plant, in which a modern scientific system gave about 25 times the intensity of the obsolete equipment formerly used, there resulted an increased production of 30 to 100 per cent in different operations. Lack of proper record systems and other difficulties prevented carrying on similar tests in other factories. So far 11 plants have had their lighting systems rehabilitated as a result of the survey and in each case, it is pleasing to note, the new equipment, though installed with little or no rewiring, has been designed to give about all that may be expected in the way of intensity and reasonable uniformity of illumination and freedom from excessive brightness contrasts and glare.

In Mr. Durgin's paper use is made of a very happy expression—productive intensities—which should have a very effective appeal to the executives of manufacturing plants just at this time when every effort is being strained to increase production to the utmost. It should be impressed on them that if production is to be carried on efficiently at any time when daylight is deficient or entirely absent, it is necessary to provide a productive intensity of artificial lighting approaching that of the average bright daylight hours. This will mean more than any definite figures in foot-candles or such expressions as improved or triple intensity. A truly productive intensity also implies proper consideration of avoidance of deep shadows and glare, both of which would counteract much of the benefit of increased intensity. Such a productive intensity, Mr. Durgin estimates, should give an average increase of at least 15 per cent in production at an increase of 9 per cent in coal consumption for factory lighting—an important increase in fighting equipment and decrease in hazards for the army. At the same time it should give incidentally greatly improved visual and working conditions and decreased accident hazards for the industrial army remaining at home.

Making the Operation of Circuit-Breakers Safer

EVER since the oil circuit-breaker came into vogue it has been accompanied by the disconnect switch, except perhaps on the generator side of the breaker in smaller installations, and similar special cases. The purpose of these disconnect switches is so well known as to hardly need repeating, namely, by

assuring an air gap, assure ability to isolate the circuit-breaker during repairs and prevent premature or accidental closing.

Used for the purpose of interposing an air gap, the disconnect switch as usually constituted is of high cost, because insulated for the potential of the circuit, it is comparatively bulky, and last but probably most important, operation of the disconnect constitutes a separate operation distinct from that of operating the circuit-breaker, a very real disadvantage since it is usually advisable to reduce the number of operations to a minimum on the score of time, safety and reliability.

A new type of circuit-breaker is now in progress of development which possesses so many valuable features that it deserves mention. The disconnective element is an integral part of the circuit-breaker mechanism; in fact, the two are interlocked. When the circuit-breaker opens, the disconnect switches or blades likewise open. When the circuit-breaker is closed, the disconnects close first, and then the circuit-breaker. Mistakes cannot occur due to carelessness or forgetfulness in failure to operate the circuit-breaker. Such a breaker also possesses the real advantage that operation of the circuit-breaker and manipulation of the disconnects constitute a single operation, instead of the usual four or at least two.

Esprit de Corps in Our Industrial Organizations

EXTRAORDINARY demands have been made on many industries to supply the large and urgent needs of the armed forces of the country and these industries, on the whole, have responded quite promptly and generously to the nation's call. In many cases, however, it has required constant urging of the employes to maintain production at reasonable speed, and in some cases special measures even had to be taken to prevent men laying off for days at a time whenever they took a notion to do so. Although the great mass of war workers recognized that the country's emergency required putting forth the greatest possible sustained effort in shipbuilding, manufacture of munitions and miscellaneous war supplies, there was a portion of the men who did not seem to grasp the importance of their tasks and who by their dilatory tactics impeded the work in many plants.

One would think that in so critical times as the present there would be few who would not regard as a rare privilege the opportunity to serve their country loyally and devotedly, whether as a soldier actively fighting at the front or, if this honor is not available, as a workman actively producing some of the numerous supplies that the fighting man needs. And yet there is drawn in the minds of thousands of workers a sharp distinction between these two services. The former is looked upon as strict national service, whereas the later is frequently regarded as merely serving the interest of the employer who may happen to have a governmnt contract. In industries not now engaged in war work and in nearly all industries during normal times, the employes commonly look upon their work as of direct benefit only to the employer who pays them their wages.

There is something radically wrong in this attitude, which is the foundation of much of the labor trouble that almost continually upsets the industrial world. It is responsible for careless workmanship, gross negligence and even the contemptible practice of sabotage. It is not to be inferred, however, that the real origin of the trouble is with the workmen. Usually it is with the employer. The evil of which we complain is lack of appreciation of the nobility and dignity of labor; failure to recognize its importance to the community, country and society in general; absence, in short, of what the French call *esprit de corps*. Unfortunately we have no equivalent English expression for this. Literally it is the spirit of the body, but actually it means enthusiastic devotion to the honor and general welfare of the organization. If we should have this as the prevailing spirit in all industrial organizations, the progress our industries could achieve would be amazing!

At first thought attempts to attain this ideal may seem like chasing a visionary chimera, which will not be overtaken until we reach the millenium. The number of commercial and industrial concerns in which *esprit de corps* has been or is being well developed is rapidly growing, however. It can, in fact, as readily be attained in an industrial as in a military organization. It is a development chiefly of education, but requires, first, a sympathetic interest on the part of the employer in the welfare of his employes. Students of economics recognize that capital and labor should be co-partners in industry, but efforts to change the present hostility to co-operation will remain fruitless until the employer takes the initiative by showing his eagerness to promote the welfare of his men.

Having shown a friendly interest, it is necessary to impress on the men that they are all parts of an important organization that is rendering valuable service to the community, and that in modern industrial development efficiency requires large organizations. Necessarily the former intimate contact between employer and employes cannot now be so close, but the interest of the two is more than ever alike. Many industrial concerns are undertaking successfully to train their employes for their particular tasks and have also developed general welfare work to a considerable extent. The larger scope of the subject, however, in which employes are acquainted with the relation of modern industrial organizations and efficiency and the importance of teamwork has seldom been presented. A noteworthy exception is the more progressive electrical central-station companies, whose example may well be copied by other industrial concerns.

General knowledge of the importance of every unit in a big industrial organization, combined with fair treatment and, if possible, profit sharing, should help to bring about the *esprit de corps* so much desired.

Week's Events

Jovians Hold Annual Convention—Stoker Manufacturers' Association Organized—Fuel Conservation Meeting Held

OKLAHOMA UTILITIES ASSOCIATION FORMED.

Oklahoma Gas, Electric and Street Railway Association and the Oklahoma Public Utilities Bureau Merged in New Organization.

The Oklahoma Gas, Electric and Street Railway Association and the Oklahoma Public Utilities Bureau were recently merged into the Oklahoma Utilities Association. The officers are: President, J. F. Owens, general manager of the Oklahoma, Gas & Electric Co., Oklahoma City; first vice-president, C. S. Thompson, manager of Shawnee Gas & Electric Co., Shawnee; second vice-president, J. W. Shartel, manager of Oklahoma Railways Co., Oklahoma City; treasurer, William Mee, president of Security National Bank, Oklahoma City; secretary, H. A. Lane, 1611 State National Bank building, Oklahoma City; assistant secretary, Prof. F. G. Tappan, University of Oklahoma, Norman. Feb. 13, 14 and 15, 1919, were the dates selected for the first annual meeting of the new organization which will meet in Oklahoma City, Okla.

JOVIANS HOLD IMPORTANT ANNUAL CONVENTION.

New Officers Elected and Changes in Constitution Accepted at Dallas Meeting.

The sixteenth annual convention of the Jovian Order was held at the Adolphus hotel, Dallas, Tex., on Oct. 24 and 25. This meeting, the most important in the Jovian year, was of particular interest this year because of the several important amendments to the constitution which were to be brought up and voted on. These changes, which were promoted by war conditions, have as their purposes the further benefiting of electrical industries by the order, increasing the membership, stabilizing the financial condition of the order and providing for a body whose duty it will be to administer all its business affairs. These amendments to the constitution, which were unanimously accepted, are substantially as follows:

1. *Article V,* dealing with eligibility of the membership, is broadened by the addition of a paragraph, which makes it possible for officers and directors of corporations engaged in the electrical business to become members.

2. *Article VIII, Section 1,* has been changed so that the dues of an active member become $2 instead of $4. Three other classes of members are created, known as: Class A, whose annual dues are $5; contributing members, whose annual dues are $10; and patron members, whose annual dues are $20. Any member can choose the class of membership desired.

Section 2 of the same article is changed to conform with Section 1.

3. *Article VIII, Section 1,* has been changed. A new set of officers has been provided for, to be known as Jupiter's cabinet. Members of Jupiter's cabinet, after the Jovian year 1918-1919, must be composed of patron members of the order who are executives in firms or corporations that are underwriting members of Jovian Leagues. Three of the members of Jupiter's cabinet, for the year 1918-1919, are elected for a term of one year, and three for a term of two years, and thereafter three are elected annually to serve for a term of two years.

4. Jupiter administers the affairs of the Order co-ordinate with other members of Congress and Jupiter's cabinet. Mercury acts as secretary of Jupiter's cabinet. Jupiter's cabinet is responsible to the Order for the faithful performance of its duties, and specifically has supervision over the management and conduct of all the financial affairs of the Order and exercises all powers of an executive nature not elsewhere placed by the constitution.

5. Mercury reports to Jupiter's cabinet in all matters pertaining to the financial and business affairs of the central office.

6. The compensation of Mercury is fixed by Jupiter's cabinet.

7. The size and form of the *Jovian Bulletin* are made subject to the approval of Jupiter's cabinet.

8. The number required to organize a Jovian League has been reduced from fifteen to five.

9. Corporations or firms engaged in the electrical business, as well as telephone and telegraph companies, may become underwriting members of any Jovian League, and as such are subject to reasonable assessments, within certain limits, levied by Jupiter's cabinet, to take care of the expense of constructive work of the Jovian central office.

The reduction in dues makes it possible for any eligible person to become a member now, while the provisions for other classes of membership leaves it optional with any member as to which class he will take. The admitting of firms and corporations as underwriting members and the establishing of Jupiter's cabinet, composed of patron members, should serve to place the order in a firmer financial condition.

Aside from the discussion of these important constitutional changes, however, the convention was of considerable importance in many other ways. Resolutions on current topics were adopted and the reports of the officers covering the activities of the order for the past year were read. The Jovians were welcomed by Hon. J. E. Lawther, mayor of Dallas, to which Jupiter J. F. Strickland responded. Among the speakers were Hon. Barry Miller of Dallas, who spoke on "The Electrical Interests and the War," and Hon. W. H. Atwell, "Our Flag and the War." Paul M. Lincoln, of Pittsburgh; Harry Monroe, of Chicago, formerly of Dallas, and H. F. MacGregor, of Houston, also gave interesting talks.

Election of Officers.

L. O. Ripley, vice-president of the Kansas Gas & Electric Co., of Wichita, Kans., was elected Jupiter

for the ensuing year. Ell C. Bennett, of St. Louis, was re-elected Mercury. The other officers elected were: Neptune, Hartwell Jolnick, Dallas; Mars, Chas. B. Burleigh, Boston, Mass.; Vulcan, G. W. Pelz, New York City; Pluto, H. E. Shelton, Wilmington, Del.; Triton, P. B. Zimmerman, Cleveland; Hercules, T. W. Moore, Atlanta, Ga.; Avernim, Guy E. Seiler, Richmond, Va.; Apollo, Galen Crew, Guthrie, Okla.; Ajax, Fred Johnson, St. Louis; Argus, Carl Golin, New York City; Amphion, W. T. Wallace, Boise, Iowa; Atlas, T. B. Burnite, Denver, Colo.; Comus, J. N. Colkitt, Los Angeles, Cal.; Chiron, Geo. E. Rough, St. Catherines, Ont.; Cadmus, H. W. Billings, Winnipeg, Man., Canada.

The new Jupiter's cabinet was announced as follows: H. J. Pettingill, St. Louis; W. B. Head, Dallas; Martin J. Insull, Chicago; Henry L. Doherty, New York; Henry Harris, Pittsburgh; J. F. Foster, Kansas City, Mo.

The convention closed with a banquet held in the main dining-room of the Oriental hotel.

STOKER MANUFACTURERS FORM NEW ASSOCIATION.

Membership of Stoker Manufacturers Association Includes Nearly All Stoker Builders in the Country.

At a meeting held recently in Cleveland, Ohio, an association of the stoker manufacturers of the United States was formed, called the Stoker Manufacturers Association. The principal reason for getting together was to place at the disposal of the Government the entire facilities of the stoker industry to the end that everything possible might be done to help out in the national emergency. Even after the war, however, it is expected that great benefit will be obtained by the association members in the discussion of subjects of interest and value to the stoker industry, in the advancement and improvement of that industry, in the standardization of stoker manufacture and application, and in the promotion of a spirit of co-operation among its members for improved production and increased application of stokers.

At the first meeting the following officers and executive committee were elected:—President, P. Albert Poppenhusen, Chicago, Ill.; vice-president, S. L. Nicholsen, East Pittsburgh, Pa.; secretary-treasurer, Fred. H. Daniels, Worcester, Mass.; William F. Sauter, Philadelphia, Pa., W. H. Rea, Detroit, Mich. The association has been informed that it has been formally elected to membership in the Chamber of Commerce of the United States. A national councillor will be appointed by the association to represent it in the national chamber, and through this national councillor the association will have an opportunity of expressing itself on national questions under discussion by the federal authorities.

The association, through its War Service Committee, has tendered to the Federal Government the entire resources and services of its members, and the committee is working with the Fuel Administration and the War Industries Board for the conservation of fuel, labor and raw materials.

The following list of charter members of the association includes practically all the builders of mechanical stokers in the country:

The American Engineering Co., the Jas. A. Brady Foundry Co., the Burke Furnace Co., the Babcock & Wilcox Co., Combustion Engineering Corp., Detroit Stoker Co., Fuller-Lehigh Co., Green Engineering Co., Illinois Stoker Co., Laclede-Christy Clay Products Co., Murphy Iron Works, Manistee Iron Works, McKenzie Furnace Co., Joseph H. Roach & Co., Inc., Sanford Riley Stoker Co., the Underfeed Stoker Co. of America, Westinghouse Electric & Manufacturing Co., Wetzel Mechanical Stoker Co., the Wetzel Mechanical Stoker Co. of New York, Inc.

WESTINGHOUSE WENT "OVER THE TOP" WITH FOURTH LIBERTY LOAN.

Enthusiastic Campaign Results in $1,000,000 Plus Subscriptions.

For five minutes, starting at 11:45, Oct. 12, the whistles of the Westinghouse industries in the Pittsburgh district proclaimed that the men and women of these companies had again demonstrated their loyalty, patriotism and good common sense by greatly oversubscribing their quota in the Fourth Liberty Loan. The grand total for the Westinghouse interests being $6,500,000 of which amount approximately $5,500,000 was subscribed by employes of the Westinghouse Electric & Manufacturing Co. and its subsidiaries.

An intensive campaign was carried on in the different works, and noon hour meetings were held every day. Four bands, all made up of Westinghouse men, enlivened interest and stimulated patriotism. In addition, a community chorus of 200 voices, a male chorus of 20 voices, and a number of male quartets and soloists were utilized to keep up the spirit of the campaign. A large Victory arch was erected on Fifth avenue, Pittsburgh, and was dedicated with appropriate ceremonies, including a concert by the Westinghouse Band and a stirring address by Edward O. Tabor, who spoke under the auspices of the Pittsburgh Liberty Loan Committee. The Victory arch attracted much attention, and as the campaign progressed crowds of pedestrians stopped to watch it and wonder how soon it would show that these companies had gone "Over the Top." The ban on public meetings and parades, necessitated by the epidemic of influenza, prevented any public demonstration when the objective was finally passed.

One thing was clearly demonstrated throughout the campaign: for intense loyalty to our government in prosecuting the great war for world-wide democracy, the men and women of the Westinghouse organizations are second to none, and fully realize their responsibility in standing back of the thousands of Westinghouse men and women who are now in the national service.

NEW YORK ELECTRICAL MEN OVERSUBSCRIBE IN FOURTH LOAN.

Excellent Showing Made by Electrical Interests in the Big City.

More than doubling its sales of Liberty Bonds for the Third Loan, when it broke all records by exceeding its former quota by a large amount, the Electrical Industries Committee of New York City, in conjunction with the Brooklyn Electrical Committee in the Fourth Liberty Loan campaign just closed has rolled up a total of $19,368,000. The work of the Committee was organized by groups in the industry, the subscriptions obtained being as follows:

Electrical Manufacturers' Agents, Charles Crofoot, Chairman .....$ 457,800

Contractor-Dealers, Louis Kalischer, Chairman	1,409,550
Elec. Machinery Manufacturers' Branch Offices, E. D. Kilburn, Chairman	10,133,550
Electrical Societies, T. C. Martin, Chairman	212,300
Electrical Supply Jobbers, George L. Patterson, Chairman	1,938,700
Electrical Manufacturers in New York, J. Nelson Shreve, Chairman	2,757,600
Total	$16,909,500
Brooklyn Electrical Committee, T. I. Jones, Chairman	2,458,500
Total, New York and Brooklyn	$19,368,000

Theodore Beran is general chairman of the Electrical Industries Liberty Loan Committee for Greater New York, James R. Strong is vice-chairman, E. Donald Tolles, secretary, and H. C. Calahan, assistant secretary. Franz Neilson is director of speakers, and O. H. Caldwell is director of publicity. T. I. Jones is chairman of the Brooklyn Committee and M. S. Seelman is secretary.

FUEL CONSERVATION MEETING HELD IN CHICAGO.

Methods for Saving Coal and Oil Discussed at Important Conference.

A very important fuel conservation meeting of the United States Fuel Administration was held on Oct. 24 in the LaSalle Hotel, Chicago, Harold Almert, director of conservation for Illinois, acting as chairman. The program of the session was as follows:

Address, by Raymond E. Durham, Federal Fuel Administrator for Illinois.

"United States Fuel Administration National Plan for the Conservation of Fuel in Steam Power Plants," by Osborn Monnett, assistant advisory engineer, Washington, D. C.

"The Principles of Fuel Conservation in Power Plants," by Joseph Harrington, administrative engineer for Illinois.

Address, W. Champlain Robinson, director, Bureau of Oil Conservation, Washington, D. C.

"United States Fuel Administration Fuel Oil Conservation Program," by Nelson G. Phelps, district engineer, Bureau of Oil Conservation.

"Principles of Fuel Oil Combustion Related to Industrial Furnaces," by Joseph W. Hays, consulting engineer, Chicago, Ill.

"Oil Storage and Measurement," by J. J. Connelly, mechanical engineer, Chicago, Ill.

"The Value of Fuel Oil Accounting Systems," by J. C. Miller, consulting engineer, Chicago, Ill.

"What Represents an Ideal Industrial Fuel Oil System," by Max Sklovsky, mechanical engineer, Deere Co., Moline, Ill.

MASSACHUSETTS CONTRACTORS AND POWER MEN HOLD JOINT MEETING.

Recently there was a meeting of the Massachusetts Association of Electrical Contractors and Dealers at the Hotel Kimball, Springfield, Mass. It was intended to hold a brief business meeting in the morning and then on invitation of A. B. Lisle, president of the New England Section of the National Electric Light Association, attend the meeting of the latter body in the afternoon. However, the launching of the Fourth Liberty Loan and the Spanish influenza seriously interfered with the attendance, and it was decided by those present that the business meeting be called off.

At 2 o'clock in the afternoon, about thirty of the members of the association assembled in the meeting room of the New England Section of the N. E. L. A. and listened to remarks by John J. Gibson, manager of the supply department of the Westinghouse Electric & Manufacturing Co., of East Pittsburgh, Pa., and William L. Goodwin, father of the "Goodwin Plan." Before adjourning, Mr. Lisle said, "It is to be hoped that this is only the commencement of many combined meetings of the N. E. L. A. and the electrical contractors."

SKIP-STOP PLAN BY STREET RAILWAYS SAVES MUCH COAL.

Preliminary Reports from Half the States Show Savings on Basis of Nearly 700,000 Tons per Year.

Operation of the "skip-stop" system by electric street-car companies in 24 states for six months saved coal or its power equivalent at the rate of 687,122 tons annually.

The Fuel Administration has made public figures showing the greatest saving in coal was in Massachusetts, estimated at 191,000 tons. Pennsylvania ranked second with an estimated saving of 169,200 tons. Missouri saved 52,422; New York, 50,000; New Jersey, 30,000; Illinois, 25,000; Ohio, 23,000; and Michigan, 22,000. Other states showing a saving of 10,000 or more were Tennessee, 18,000; Connecticut, 15,000; California, 11,000; Minnesota, 10,000; and Wisconsin, 10,000.

It is estimated that the saving in electric power amounted to about 1 per cent of the power used in operating the cars. The plan has also increased the schedule speed and improved the service, which has been appreciated by the public. Very little complaint has been reported from putting the plan into effect.

EXPORT INTERESTS DISCUSS TRADE POSSIBILITIES AFTER THE WAR.

The American Manufacturers Export Association held its ninth annual convention at New York City, Oct. 30 and 31. The principal topics discussed were the conditions expected to arise after the war and preparations for combating them. The vital nature of this subject attracted many representatives from foreign trade organizations, banking and shipping interests and chambers of commerce throughout the United States. The result was one of the most representative gatherings of foreign trade interests ever held in this country, which in itself should prove a great help in solving our reconstruction problems. In addition the speakers arranged for the occasion were men whose close association with the affairs of the nation makes their advice in matters of this nature invaluable.

The consensus of the opinions expressed was that aggressive measures for carrying on a much more extended foreign trade must be undertaken without delay. The big merchant marine sailing under the United States flag as a result of the war's extraordinary shipbuilding activities will be a most valuable aid to our exporters. The prestige created by our shipments of American products to many markets in recent years that seldom or never saw our goods should be maintained against the competition of the whole world.

After-the-War Reconstruction

A Reconstruction Program

THE problems, both industrial and civic, that must be faced after the war are so serious that in practically all of the countries affected plans have already been laid to systematically and energetically meet the situation. Only in the United States has reconstruction been given little or no consideration in a national way. Several industries and many individual manufacturers are, however, beginning to plan for the future. The electrical industry should not be backward in this respect. It is to be of guidance to the electrical industry that the ELECTRICAL REVIEW will endeavor, in this department, to offer constructive suggestions regarding various timely phases of after-the-war conditions.

Every branch of the electrical industry is vitally interested in what the future holds forth, and while many problems are of equal interest to the entire industry and must be solved jointly, there are nevertheless numerous individual questions affecting solely or chiefly the individual branches. For instance, the future policies in regard to line extensions of central stations, electric railways and telephone companies must be solved finally by these utilities, although every branch of the industry is interested to a more or less extent. Likewise, electrical manufacturers among themselves must solve the numerous new problems that have been raised regarding standardization of products, elimination of an excessive number of types or styles of such appliances as vacuum cleaners, washing machines, heating devices, etc.

The electrical industry is in a sense better organized than any other industry, at least in so far as having representative associations is concerned. It seems, therefore, that the first step in the after-war reconstruction program for the electrical industry should be the immediate appointment of committees representing the different branches of the industry to actively study the problems of particular interest to each branch. The co-ordination of effort that is necessary in a task of this magnitude could well be handled by a joint committee made up of representatives from each of the existing half dozen strong national electrical associations. We have heard much about co-operation in the electrical industry; here is a splendid opportunity to put it at work. The conditions to be confronted are in many ways similar to those which prevailed during the mobilization period and which still prevail to a large extent.

Reference was made in our issue of Oct. 19 to the work of the War Industries Board and how the same plan and, in fact, the same organization could be utilized for working out the national features of the reconstruction period. In the same way the same boards and committees which are representing the electrical industry in its war-service relations with the Government could no doubt handle in a similar manner the corresponding problems of reconstruction, at least to the extent that these will need continued co-operation with the Government.

It is, of course, impossible to predict with any degree of certainty what the real conditions will be after the war is won. It is a significant fact that the best posted men are almost invariably the most reluctant to hazard an opinion. There are, however, certain fundamental principles which must govern all of our activities when peace comes again and much can be done in the way of preparation so that the chaotic conditions early in the war are not repeated.

Destructive as war is, it has also resulted in most astounding scientific, industrial, economic and political developments which will put the progress of the world ahead by many decades at least. Among these of special interest is the marked impetus given to the co-operation for the national good of former keen competitors in almost every industrial and commercial line of business. Another is the great increase of governmental authority over industry in general. Still another is the stimulus to elimination of waste in fuel and other resources. These developments arose directly as war measures. Now that peace is looming on the horizon, it is well to consider which of these and many other war measures are worthy of being perpetuated on account of their economic worth. Failure of thoughtful planning for the reconstruction period by the nation as a whole and by each of its industries would, on the declaration of peace, be liable to make us quickly forget the constructive lessons of the war and cause us suddenly to plunge back into ruinous competition and wasteful methods in the scramble to put business back on its old foundation as quickly as possible. The electrical industry is in excellent condition to take up a careful co-operative study of these matters so that it as a whole and each of its various branches may profit from the developments of the war and prepare themselves best for whatever the future has in store.

In considering the subject of after-the-war reconstruction in the electrical industry in a broad way, there are certain problems that stand out prominently and it will be to these that first attention will be given in this department. Later an attempt will be made to enter into a detailed discussion of the numerous problems that will confront the various branches of the industry. In this discussion the results of an extended study will be disclosed, together with the suggestions of well-known authorities on their respective subjects.

in the Electrical Industries—II.

In this department the ELECTRICAL REVIEW *will present at frequent intervals items dealing with the after-war reconstruction activities in the electrical industries. Manufacturers, jobbers, central stations, contractor-dealers and all others interested are urged to contribute full particulars of any activities in this direction so that the industry may benefit from an interchange of such comments.*

BRITISH PREPARATIONS FOR RECONSTRUCTION.

Discussion of Problems Confronting New Minister of Reconstruction.

BY ALBERT H. BRIDGE.

The resolution of the British Government to set up a Ministry of Reconstruction was approved by the House of Commons early in August after some discussion as to the legitimate scope of its operations. For a long time past the multitudinous questions already raised, as well as those which can only as yet be anticipated, have been undergoing investigation in special government departments, also by a cabinet subcommittee, and by a number of expert committees concerned with particular industries and trades. By such means a vast amount of material has been accumulated which is expected to be of assistance in the shaping of future policy. Such material is concerned with education, science, industry, the needs and aspirations of labor, and their possible reconciliation with the legitimate aims and objects of industry. But, notwithstanding all that has been done in the above ways during the last two or three years, and all the efforts made by scientific and industrial organizations as well, on their own account, it is only now that the British Government considers the advancing state of the world situation to justify making a definite appointment of a Minister of Reconstruction.

The man chosen for the appointment is Doctor Addison, who has been at the helm of the munitions organization and supply, and has therefore had more to do with the reorganization of British industries than perhaps any other man in England. He has good reason for knowing how enormous have been the additions made to iron and steel, engineering, and other works for the purposes of war munitions manufacturing, also how deeply the changes over from one industry to another have cut into the life of the nation. For these and other reasons he is therefore well able to estimate the seriousness of the situation that will arise when what has been termed the "general post" period arrives on the cessation of munitions manufacturing; he will have in mind, further, the problem of continuing in operation, though for peaceful industry, the new factories already referred to, and the manning of them with suitable labor.

SCIENCE AND THE NATION.

As has been pointed out in the ELECTRICAL REVIEW from time to time, many measures have been introduced in England for the purpose of raising the standard of national efficiency for war which will be equally applicable, and perhaps even more necessary, for the post-war period. It must not be imagined that because the ministerial appointment has only just been made that investigations and schemes will start *de novo*. The setting up of the Advisory Council of Scientific Research by the Privy Council and the manifold activities in special directions consequent thereupon have given science, and practical scientific application, such a standing as they never had before, and a new and large place in the councils of the nation is assured for science and the scientist in the future. This has caused those responsible for educational matters to have high hopes that the study of science will receive greater attention in the training of the youths in the schools and colleges. The senate of the University of London has issued certain proposals for improving the facilities for scientific education. It mentions the fact that almost all the head masterships of the great public schools are held by those who have taken classical degrees and consequently in the schools in question the classical teaching is excellent but science is relegated to an inferior position. In the opinion of the senate, the student should first obtain a general degree in science and then specialize in some branch of science or in the application of science to industry. It also offers the criticism that the headships of many government departments are in the hands of classical men although the work is chiefly scientific and technical. The senate holds that the nation has suffered seriously from this state of things. Lord Haldane has lately expressed the conviction that the subject of education is the greatest of all matters to be dealt with in the work of reconstruction. He holds that if we tackle this well, many of the other reconstruction problems will settle themselves. Educational matters, and the place of science in relation thereto, will not be one of Doctor Addison's post-war problems as they come under the purview of a special minister.

INDUSTRIAL ORGANIZATION.

Another direction in which the Minister of Reconstruction will find that important headway has been made during the war is the organization of industries. To some extent, perhaps, we ought to say to a large extent, the individual spirit which was supreme in many departments of British industry before the war, has been broken down. Hundreds of manufacturing concerns, large and small, have come together in federated organizations for the purpose of overwatching and furthering in any way possible the interests of their particular industries and their own businesses. It is their idea to act co-operatively in securing more effective organization, more efficient production, and markets for a greatly increased output, so that there may be plenty of work for labor and a fair return on capital invested in industry, when war labor returns to its former vocation and demands work.

Side by side with the progress of federation among manufacturers there has been a strong movement in the direction of federation of labor. The trade unions have been joining hands and though their forces are not yet finally consolidated, such federation or amalgamation as has taken place has created a new state of affairs for good or for evil. Neither the employers

After-the-War Reconstruction

nor the employed are completely federated, but when main principles are brought into the arena for settlement, if they ever are, there will probably be unity of aim on one side against those on the other, whether all are federated or not, unless measures can be taken in time to "bridge the gulf." This bridging of the gulf is regarded by some wise men as the first and greatest of all problems of reconstruction. As Lord Haldane thinks is the case with education, so others think to be the case with the bridging of the gulf between capital and labor—if this can be secured many other problems will solve themselves. But the bridge is not yet properly designed let alone constructed and Doctor Addison, though he will find that many efforts have been made to secure a suitable atmosphere in which industrial peace negotiations can take place, knows that the atmosphere is very variable and that the negotiations have not been carried very far. An alliance has been established for bringing the two sides together in conference, and other organizations are working to the same end, but it is recognized that the workers require education as to where their own real interests lie and how those interests can be best protected, before they will see that the past policy of restriction of output is opposed to their own and indeed to all interests. Just at present there is a demand which is growing louder in certain labor sections for the right to "control industry." We may yet witness a big struggle around this demand.

Changes in British Industries.

The Minister of Reconstruction comes on the scene at a time when from many electrical and other industrial companies there has been eliminated the large enemy interest. Under the supervision of certain government departments some such interests have been sold to existing, entirely British manufacturing groups and these groups are ready to take up after-war operations with a revised and co-operative organization, which conducted with efficiency may be expected to promote industrial activity such as a Minister of Reconstruction is naturally eager to insure for coming days. The proceedings of expert committees which held prolonged sittings to investigate the possible situation of special industries after the war, particularly the engineering trade, the iron and steel industries, the electrical trade, the textile trade, and so on, are all ready in the hands of the new minister, and though their recommendations have not been publicly divulged, they contain much material which will be needed if reconstruction policies and plans are to be based upon the views of those whose experience in the great industries has been lengthy and specialized.

Doctor Addison stated recently that it would be very discreditable to the nation if we did not succeed in placing some British industries on a firmer and more scientific foundation, and one of his first acts as new minister was to hold conference with leading representatives of British chemical industries. He discussed the after the war prospect with them and remarked that one of the most urgent and difficult matters that would arise after the termination of the war, or perhaps even before then, would be the supplies of essential raw materials. In some of them there was at the present time a world shortage. The British nation could only pay for the war by increased production. "We should aim at making three ears of corn grow where two grew before." The output of all the industrial plants in the country must be increased as far as possible, and that meant at the same time improving their processes. By promoting understandings with labor they would be able to so proceed as to give those engaged in industries a direct interest in the introduction of improved methods. More and more will it be desirable to make full use of skilled supervision and assistance and of the lessons of research so that manufacturing standards will be brought up to the highest pitch of perfection.

The Minister of Reconstruction in uttering sentiments of the foregoing character added that it would not be his desire to promote nostrums of any sort or kind to deal with the situation that they all had to face.

Finance and Future Industry.

While the above-mentioned authorities place different matters prominently as being the most urgent, some, education, a slow process surely when situations clamour for remedial measures; others, harmony between capital and labor, a plant of slow growth unless the soil be improved by the removal of brickbats of the past; the Chancellor of the Exchequer and hard-headed leaders of industry recognize that finance will be one of the first of all claims if industry is either to resume its pre-war course or to become more progressive and efficient. Manufacturers who have turned over to munitions work may have made good profits therefrom but the government excess profits tax takes care of the profits, and the provision for depreciation of war-used machinery and equipment has to be high, and ordinary export trade connections have been in a state of suspension. New capital for industry will be needed in all directions. Some works have accumulated reserves which will assist them in this connection and will also tide them over the difficult transition period of trade, but it is the Chancellor's recognition of the needs of trade and industry for financial assistance that has led to the organization of the British Trade Bank or corporation, one of whose objects will be to assist British industry to stand up against the efforts of Continental Cartels and bank-assisted industrial organizations.

ASSOCIATION OF ENGINEERS APPOINTS RECONSTRUCTION COMMITTEE.

The National Executive Committee of the American Association of Engineers, having in mind the increasing importance of reconstruction questions, has appointed a committee to give the matter general consideration. No more ambitious project has ever been undertaken by the association, and none has been undertaken which will prove to be more vital to its aims, is the view of the association's organ, the *Monad*. The committee consists of Isham Randolph, chairman, Edmund T. Perkins, Gardner S. Williams and Samuel Moreel, secretary. The committee will join forces with other agencies throughout the country that are now studying this problem.

Commercial

War-Time Policies as to Extensions of Lines and Service Drops—How Electric Welding Can Be Made Successful

CONSERVATION IN LINE EXTENSIONS NOW NECESSARY.

Empire State Gas and Electric Association Issues Appeal to Member Companies to Minimize Line Extensions.

In many states the utility companies are required by law to make reasonable extensions to their lines in order to serve customers that apply for service. On account of the war conditions, however, which require that labor and materials be conserved to the utmost for purposes directly connected with the conduct of the war, and also to curtail capital expenditures for extensions as much as possible, it has been found desirable to appeal to the utility commissions so as to secure relief from strict enforcement of the public utility laws in this respect. This relief has usually been granted.

In order to bring this matter to the attention of its members, C. H. B. Chapin, secretary of the Empire State Gas and Electric Association, has issued from his New York City office the following letter to the member companies:

"In the conservation of labor and materials which is essential to the successful prosecution of the war, an important, although perhaps unwelcome duty, devolves on all gas and electric companies.

"Every extension of mains and in fact every service connection means the expenditure of labor and materials. Unless, therefore, such extensions or service connections serve some direct war purpose they are interfering with the production program of the country and with keeping our army and navy supplied with those things necessary for victory.

"Under the state law gas and electric companies cannot refuse to furnish service to applicants within 100 feet of their mains. There are, however, two things they can and should do.

"First, they should discontinue soliciting any business, except of course war business, where their service is not already in the premises. This step should be taken in order to release labor and material for war purposes and entirely independent of whether the company has surplus and unused capacity or not.

"Second, they should give the fullest possible publicity to the situation, explaining it to the municipal authorities and to all applicants for service. The public should be brought to look at the matter from a national standpoint. The slight saving in any individual case appears unimportant, but multiplied by the large number of similar cases throughout the country it assumes a very different aspect.

"We appreciate that, where a company has service to sell, the adoption of the above suggestions will mean relinquishing the possibility of securing some much needed revenue. We have, however, enough confidence in the wholehearted patriotism of the men in the gas and electric business in this state to feel sure that they will cheerfully make this sacrifice and cooperate in this matter as they have in all other requests which have been made to them in this national emergency."

This notice was sent after conferring with the Capital Issues Committee and the War Industries Board in Washington.

CONSUMERS HELP TO FINANCE INSTALLATIONS.

Elmira (N. Y.) Water, Light & Railroad Co. Finds New Method Successful.

The financing of service drops and line extensions is becoming a very important matter to central-station companies. Before the war, when securities could be marketed to good advantage any time, only those extensions which involved a considerable amount of money gave the companies any concern. Now, however, since money cannot be borrowed to advantage on the market, companies having ample capacity available are puzzled as to how to finance these extensions satisfactorily.

Many concerns have been installing short extensions or service drops free for some time but have required the customer to stand part or all of the expense for larger installations. Individually, these short extensions do not amount to very much, but for the ordinary central-station company the total is considerable. The financing of these is therefore becoming a problem to the companies. The *Bulletin* of the United Gas & Electric Corporation recently published a plan conceived and perfected by General Manager F. H. Hill and Commercial Manager R. W. Hoy of the Elmira (N. Y.) Water, Light & Railroad Co., by which the Elmira company is doing this financing with considerable success.

As soon as word is received that a building is to be wired, a representative of the company is sent to call on the owner. He frankly informs the owner that in order to get immediate service it will be necessary for him to help finance the cost of the installation. He explains that the Government has asked all utility companies to refrain from placing their securities on the market at present, in order that their sale may not interfere with the sale of Liberty Bonds, but that the increased cost of labor, fuel and materials make financial assistance necessary. It is explained that he will, therefore, have to deposit with the company an amount covering the cost of the construction necessary, this amount to be returned with 6 per cent interest as soon as securities can again be placed on the market. It is also explained that almost any bank will loan money at 6 per cent interest, which will leave the customer in the same condition, financially, as before.

The cost of an ordinary connection is estimated at $11. So far this year the company has connected 600 old houses to its lines. The amount of money, therefore, that was involved in these seemingly small jobs has proven to be considerable. The customers also, having been shown the reason and need for the re-

quest, are satisfied. This plan was given all the publicity possible in order that any prospective customer might become familiar with this rule before having his premises wired.

ELECTRIC WELDING DEPENDS LARGELY UPON MATERIALS AND THEIR APPLICATION.

Methods Which Were Used Successfully in Nearly 20,000 Jobs.

That electric welding, as a means of repairing cracks or other defects in boilers, has many advantages has been almost universally admitted. That the repairs made by this method will be as strong and lasting as the original material without affecting the surrounding metal, is however, still held in doubt by many, in spite of the progress that has been made in this art. In tests made in 1909, the tensile strength of welds was found to be about 18 tons per sq. in. Recent tests show a tensile strength of about 27 tons per sq. in. is attained although 20 tons per sq. in. is recommended as the safest strength to work to on account of possible defects. This tensile strength can be reached without affecting the surrounding material. The success of the operation depends to a large extent upon the materials used and their careful application. The means and materials which have been used with considerable success in England were brought out recently in a paper read before the Institute of Marine Engineers by R. S. Kennedy.

Preparation for a job of electric welding is a matter of considerable importance, as the presence of impurities is likely to be detrimental to the weld. In dealing with the external or fire surfaces of a boiler it is usually sufficient to use an ordinary chipping hammer and then thoroughly wirebrush the metal, however, the ideal preparation is to take a light chipping over the surface. Greater care is necessary when dealing with the water surfaces especially if zinc plates have been freely used. The crack should be veed out enough so that the welder can reach with his pencil on either side with a certainty of striking his arc in any required position. In dealing with cracks it is absolutely essential that the whole of the fractured portion be cut away, and a very good guide is to cut away until a solid chipping is obtained and then go a bit deeper to be on the safe side. When welding over a riveted seam, rivets in the welded area should be completely welded over, not left half-covered.

In common with hand-welding, a good job depends on the conscientious work of the man. It has been found a good plan for firms to train their own men for this work and to keep these men constantly employed. In common with other skilled workmen the welder should act as a superintendent in the chipping and cleaning processes only performing the actual welding process himself. To inculcate a sense of responsibility among the welders it has been found to be a good plan to keep a record of each job with the welder's name.

The iron wire used in welding should be of the best material, preferably, with a small percentage of manganese. To provide against oxidation and also to increase the fluidity of the metal, a flux is necessary to obtain successful results. The most convenient method of applying this flux is to coat the metallic electrode evenly with it. This provides a constant and uniform supply. The voltage used is from 22 to 25 volts across the metallic arc. A substitudinal switch should be installed which is put in the circuit automatically when the welder breaks his arc, thus steadying the load on the generator. The current employed is about 175 amperes although it is advisable to use a larger generator than this load would indicate.

Mr. Kennedy states that of about 20,000 jobs, the percentage of even partial failures is so small as to be almost negligible. Moreover, the majority of these failures are found to be cases where the work was carried out under unfavorable conditions, often in the nature of a forlorn hope.

INCREASING OPERATING COSTS FORCES ANOTHER COMPANY TO INCREASE RATES.

The increasing prices of material, fuel, etc., have forced the Helena (Ark.) Gas & Electric Co. to a second increase in rates this year. This company originally sold electricity at 20 cents per kw-hr. As soon as operating conditions permitted this was reduced, voluntarily, to 16 cents per kw-hr. In February, 1917, another voluntary reduction further reduced the price to 13 cents per kw-hr. The first increase due to high prices became effective May 1, 1918, and it was hoped at this time that by careful and painstaking business planning, this increase would be sufficient, although it was realized that the new price was less than conditions required. Continuing high prices, however, have made the second increase imperative. This increase became effective Oct. 21. This new rate is based on the block-rate system with separate minimum bills.

In the announcement sent out to customers, the company explains that this increase is temporary, and as soon as conditions permit the prices will again be reduced. It is explained that the company has been operating at a loss of about $500 per month for the past seven months and several of the items whose additional cost brought about the increase are mentioned. The increased taxes and the new freight rates are shown to be an extra expense of about $10,000 a year to the company besides the increased cost of other materials amounting to 300 per cent in many cases.

TEST PROVES ECONOMY AND EFFICIENCY OF ELECTRIC FURNACE.

Recently the Louisville Gas & Electric Co. installed an electric furnace in the plant of a manufacturer of sanitary bathroom articles. An eight-day test of the installation shows that not only was there an actual saving in money per 100 lb. of metal poured, but there was a decrease in metal loss and a fuel economy of nearly one-third.

The summary is as follows:

	Per 100 lbs. of metal poured with—		
	Oil.	Electricity.	Improvement.
Cost in cents	24	19	20%
Metal loss	7 lb.	1.13 lb.	51%
Heating units required	708,000B.t u.	475,000B.t.u.	32%

PUEBLO REPORTS 2676 APPLIANCES SOLD THIS YEAR.

Since the first of the year the Arkansas Valley Railway, Light & Power Co. and the electrical dealers of Pueblo, Colo., have sold 2676 electric household appliances, of which 1477 were flatirons and 181 fans.

Operating

Transformer Cutouts—Supporting Telephone Lines—Abuses of Stokers—A Problem in Voltage Regulation

REDUCING THE HAZARDS OF TRANSFORMER CUTOUTS.

Expedient for Saving Linemen While Replacing Fuses on Short-Circuits.

By Harold P. Wallace.

Notwithstanding safety movements, educational campaigns and similar commendable practices, the fact remains that in the vast majority of cases the lineman who replaces a fuse in a porcelain transformer cutout for a transformer of large capacity is taking a chance. Many of the cutouts or fuse blocks on the market are incapable of withstanding the stresses that accompany a severe short-circuit and the blowing of the fuse. These cutouts shatter and the porcelain is hurled into the face of the lineman.

Every lineman has experienced the above and appreciating the danger, has adopted various methods of determining whether the cause of the fuse blowing still exists before replacing a fuse. Perhaps the most common way of doing this is to tap one side of the transformer lead against the live conductor, and judge from the accompanying arc whether or not conditions are normal. It often happens that the fuse blew because of a very heavy load carried by a corroded fuse, but the linemen are unable to distinguish between the various causes of a fuse blowing, and thus play safe by tests, or by cutting off some of the load. All these things take time, which is precious when lights are out and service interrupted, and these may often be dangerous in themselves on a wet night.

To overcome the inherent defects—and the term inherent is used because to the writer's knowledge there is no porcelain cutout on the market that can be relied upon to protect a 2300-volt distributing transformer of 50 kw. and above—of the porcelain cutout for high capacities and high voltages the writer has found it a safe, convenient and time-saving practice to use what he calls selective fusing of large distributing transformers.

To make the matter clearer: If a 2300-volt distributing transformer of 50 kw. is installed, there would in the ordinary way be two transformer cutouts (except for a 4000/2300-volt 3-phase 4-wire circuit). The writer would fuse one of these cutouts about 25 per cent less than the other cutout. Then in case of trouble it would be at once known which cutout required attention, because the cutout carrying the smaller fuse would be standardized; for example, that on the left-hand side of the transformer, when facing the high-voltage side. The cutout with the larger fuse would be removed, the smaller and blown fuse would be replaced, and the heavier unblown fuse would then be inserted in the cutout. If the cause of trouble still existed, the smaller fuse would blow, which being on the other side of the transformer, far removed from the lineman, comparatively speaking, would not constitute a hazard to the extent that it would were the cutout directly in front of the lineman's face.

The above practice has much to recommend it. The linemen feel safer, they appreciate that their employer appreciates the danger of the porcelain cutout and has attempted to reduce it. Trouble is found sooner and more safely.

TROLLEY SPANS FOR CARRYING TLLEPHONE LINE.

Innovation by Electric Railway Company Overcomes Several Difficulties.

One of the problems that has presented itself to electric interurban street railways has been that of catering to the heavy traffic occasioned by the activity of munitions plants, and the need for building tracks and erecting trolley lines to factories that have sprung up. The problems presented have been largely those dealing with rolling stock, materials and labor.

In one recent instance a street railway company was called upon to operate an extension of trackage of

Supporting Telephone Line From Trolley Span Wires.

considerable length, several sections of which were of single track. For this reason it was necessary to install a telephone system to permit of dispatching the cars over the single trackage. For certain political reasons it was objectional to use the poles supporting the trolley for carrying the telephone line and the company determined not to carry its telephone line on the poles carrying the trolley and the light and power conductors which were owned by another and separate company.

Instead of carrying its telephone line underground, or purchasing service from the telephone company, the first not practical, the latter not desirable because of the heavy cost of making the installation, the company adopted a rather interesting and every economical form of construction. The telephone lines, two No. 8 galvanized iron wires, are carried by the span wires carrying the trolley wire.

The telephone conductors are supported in split-

tube porcelain insulators about 2 in. in length, these tubes being placed about 8 in. apart, so as to preclude swinging together of the conductors between spans during windy weather. The split tubes are clamped together by a strip of galvanized iron which is bent round the tube and bolted to the galvanized clamp bolted to the guy wire. The arrangement is very inexpensive, is most simple, and is claimed to be very much cheaper than had pole line insulators and pins been used for a line carried by the poles.

ABUSES OF STOKERS.

Incidents Indicating Inexcusable Conditions in Boiler Rooms.

By Micheal O'Leary.

The Government questionnaire on power plants after covering the equipment and its condition takes up the matter of supervision, because the best apparatus and the highest grades of coal may be wastefully used and much waste ensue if the labor operating them and the supervision of the plant are incapable, lax or lacking.

Of late, one of the main points to be considered in improving the boiler room, since new apparatus may not be obtainable, as brought out by the various fuel conservation meetings throughout the country, is the exercise of greater care and superior supervision. The more one becomes conversant with boiler rooms the more one wonders that more accidents do not happen, that more coal is not wasted, and that many plants are able to continue in existence as is the case. In one large plant recently inspected by the writer were a number of 500-hp. boilers. The only instruments in the plant comprised a venturi water meter for measuring the make-up water. There were no draft gauges, no steam-flow meters, no thermometers, CO_2 recorders or any other instrument except a steam gauge to each boiler.

The boilers all operated in parallel, each boiler being equipped with mechanical stokers. Some of these stokers were chain grates, some underfeeds. Soon after the underfeeds went in, two furnaces were so equipped, it was found that the brickwork would not stand up except for a very short time. Complaint was made that the setting was incorrect, the stokers were no good and would not be accepted until brick troubles were eliminated.

Investigation showed that the two underfeed stokers were operating between 200 and 300 per cent rating and often higher. The chain grate stokers with their natural draft had their speed, which means rate of fuel burning, controlled by the firemen; also their air supply. On the other hand, the underfeed stokers with their forced draft had both coal and air controlled automatically according to the steam pressure. Under these circumstances, when the steam pressure dropped as the load came on suddenly, the underfeed stokers attempted to pick up the load instantly and automatically, whereas the hand-controlled chain grates continued their rates of combustion until the fireman attended to them. The result was that the underfeeds did an excess of work, grabbing the load, thus eventually burning out the brickwork.

It might be mentioned that the use of steam-flow meters on the individual boilers, or at least on those equipped with underfeed stokers and forced draft, would have enabled individual boiler performance to be known and proportioned pro rata, instead of nothing being known about the plant. Weighing the coal to each stoker would also serve much the same purpose, while the use of draft gauges would have helped considerably.

During the winter of last year the writer visited another plant containing 10 boilers of 500 hp., each equipped with underfeed stokers. This plant was serving a load considerably in excess of its capacity and boilers as well as generators were hard put to it to carry the load. The underfeed stokers were new, replacing another type of stoker now going out of use. With eight of the new stokers in use, word came that the stoker grates were burning out for no apparent reason, that something was wrong and that something had to be done to set things right. The plant was visited at a time when one stoker, the second one to require it, was having new dump plates installed to replace a set that had been burnt after only a short time in service.

In passing down the boiler aisle the writer immediately saw that the boilers were operating at about 150 to 200 per cent rating. He also saw from the draft gauges that some of the pressures under the fire were exceptionally high, suggesting excessively thick fires, insufficient stack damper opening or similar operating condition. In waiting around the plant for a while, looking at the fuel beds, keeping tab on the draft under and over the fires, wind box pressures and position of breechings dampers, etc., the writer also inspected the ash pits. In looking into the fire and later up into one ash pit underneath the grate, the flame could be seen to be passing into the ash pit apparently as much as up through the boiler passes. A closer inspection through the ash pit immediately showed that flame was playing continually around and underneath the dump plates and grates. Opening the damper in the breeching resulted in instant cessation of the flame around and under the grate and dump plates, these flames passing over the normal path up toward the boiler tubes.

Draft gauges were installed to indicate the draft under and over the fire, and the condition as found to exist rehearsed. It was shown the firemen that as the rates of combustion changed, and as the blower speed increased and likewise the amount of air being forced through the fire, the breechings damper was not opened sufficiently nor synchronously. The result was that the gases and heat from the fuel bed instead of passing up through the boiler passes unhampered to the stack, found a duplicate path under the grates through the ash pit doing damage and wasting fuel. This was the reason the grates and dump plates had burnt out, a cause directly due to carelessness on the part of the firemen and lax supervision of the worst sort. The situation ought to have been suspected by the engineer the first time it happened. The installation of draft gauges would have prevented the occurrence, providing the men understood the significance of their indications.

A PROBLEM IN VOLTAGE REGULATION.

Auxiliary Coil for Contact-Making Voltmeter Solves Problem.

In operating four-wire three-phase distributing circuits it is the usual custom to serve the various single-phase loads from what are called phase centers. Voltage regulation is then carried on for the phase centers, the drop between phase center and station being compensated for. In this way good voltage regulation for the single-phase loads, comprising largely lighting, is

obtained when the various loads of the phases are radically different and the distance of the phase-centers from the station also different.

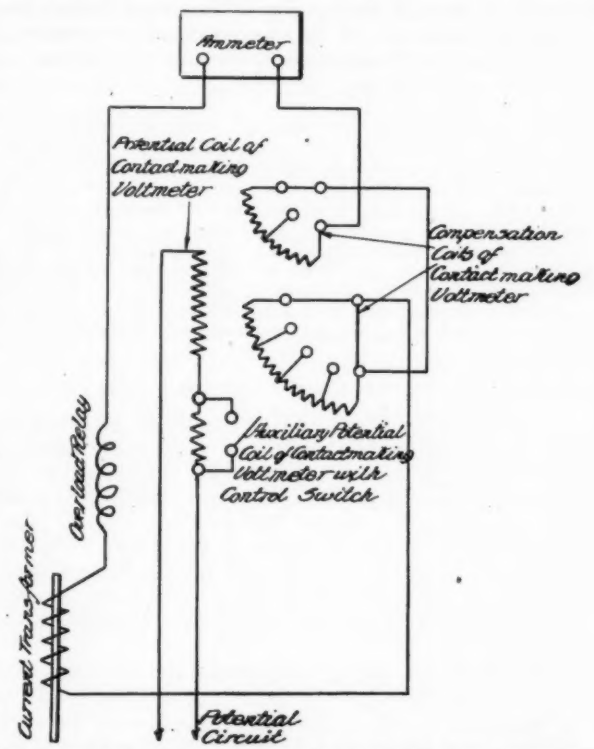
With the three-phase, four-wire circuit, the single-phase loads are taken off between phase wires and neutral, the power or three-phase loads between phases. Now it often happens that in outlying districts, and where the load density per city block or unit of territory is not dense, that the single-phase load, which comes on at night, is small compared with the three-phase load during the day. Moreover, it often happens that the location of the three-phase load and the single-phase load centers do not correspond, that is, the voltage drop for the two classes of load is different, contributing to which is the power-factor of the power load.

Good voltage regulation is important for good lighting and economical lamp life. While voltage regulation need not be within so close limit for power as for lighting, it is important on the score of income, motor capacity and temperature rise that where the loads are heavy and their duration long, the voltage be maintained as near normal as possible. To fulfill these two conditions, namely, maintain close voltage regulation during the day and night for two different classes of load situated at two different locations or distances from the station, hence, having different voltage drops, does not appear a simple matter on first consideration, especially when automatically operated induction regulators are employed. However, it may be of interest to explain the way in which this condition has been met quite successfully and very simply and inexpensively by one large distributing company.

The problem was this: A three-phase power load was transmitted a considerable distance past the single-phase load centers. The voltage regulation for this power load was required to be very close, hence the contact-making voltmeters controlling the induction regulators were carefully compensated to care for the voltage drop at the average power-factor of this load. Now, it so happened that the lighting load at night was also heavy, and the phase centers of these loads were several thousand feet nearer the station than the three-phase load. Under these circumstances, obviously, the night voltage would be much higher than that required, because the induction regulators were regulating for the line drop between the station and the power load.

One way to put matters aright would be to maintain two settings of the contact-making voltmeters, but this is a very objectionable way for several reasons. To do so means frequent movement of the compensating switches, conducive to their working loose, falling off their correct settings, interfering with voltage regulation, and opening up the secondary of the current transformer. The most serious aspect of this latter is that the circuit-breaker trip coil would become inoperative, leaving the circuit unprotected in case of trouble and circuit trouble would be communicated to the station bus. Apart from the objections, there is the fact that various phases or circuits may require different settings, and mistakes can easily arise from this fact during the busy period of the day when the settings must be changed. To overcome all objections to the use of two different line drop compensator settings, the following method was adopted:

The compensated type of contact-making voltmeter consists of two coils, one a current and one a potential coil. These are in the form of a solenoid and the two windings are wound differentially, so that the flux set up by the current coil opposes the flux set up by the potential coil. In the solenoid a plunger works, supported by the flux set up by the potential coil. This plunger operates contacts controlling the motor of the induction regulator. With a load in the circuit, represented by the current or compensating coil, the flux opposes the flux of the potential coil, the resulting flux is reduced, which determines the location of the plunger, and the plunger moves downward, operating the motor by the contacts it controls. When the potential is too high the plunger is raised and enables the regulator to operate in the opposite direction, bringing the potential of the circuit to the desired value. The compensating coils of this instrument, as shown in the accompanying diagram, permit of being changed according to the constants of the line.


Ammeter
Potential Coil of Contact making Voltmeter
Compensation Coils of Contact making Voltmeter
Auxiliary Potential Coil of Contact making Voltmeter with Control Switch
Contact Relay
Current Transformer
Potential Circuit

Auxiliary Coil for Contact Making Voltmeter for Regulating Voltage for Two Different Pressures.

In the case referred to it was required to maintain a potential of 117 volts at the power load during the day and a potential of 115 volts at the phase centers during the heavy night load between 6 p. m. and 10 p. m. The result was accomplished by inserting an auxiliary coil in series with the potential coil of the contact-making voltmeter, with such constants that when cut in the potential required to hold the plunger decreased two volts (the difference between 117 and 115 volts), a value easily calculated when the constants of the instrument potential coil are known. The auxiliary coil should be made of wire having a temperature coefficient approaching zero.

During the day the auxiliary coil is short-circuited by a 5-ampere knife switch, and the contact making voltmeter works normally. When the power load goes off and the lighting load commences to come on the switch is opened and the voltage at the phase centers drops two volts, thus enabling two different loads at different times to be supplied at the two desired but different pressures. The above scheme can be modified for various requirements, in this way extending the usefulness of the contact-making voltmeter.

Contracting-Construction

How the Inspector Has Improved Electrical Construction —Reversal of a Compound Motor—Among the Contractors

IMPORTANCE TO PUBLIC OF INSPECTION OF INTERIOR WIRING.

Slightly Condensed from a Paper Presented Before the Recent Convention of the International Association of Municipal Electricians—Second Half of Paper.

By William S. Boyd,

Secretary, Western Association of Electrical Inspectors.

[In the first part of this paper, published in last week's issue, Mr. Boyd showed how the attitude of the business man, the householder and the electrical contractor toward electrical inspection has changed from hostility to keen appreciation. In the second part, appearing below, he reviews the attitude of the electrical manufacturer and the central station. Long and intimately associated with the development of electrical inspection, Mr. Boyd is peculiarly qualified to discuss the importance of the inspector's work and how it has served to improve electrical construction methods and reduce electrical hazards.]

The Electrical Manufacturer's Estimate.

The early lighting outfits were series arc systems and the fire-producing record of these early installations tended to create apprehension which led to restrictions confining their use to street lighting for some time and greatly impeded the progress of the companies manufacturing this type of apparatus. The development of rules for the safe installation of these systems and inspection under them gradually removed the embargo and the manufacturer's business prospered.

The incandescent lighting system did not have such a stormy childhood as its older brother, but it had to struggle to live down the bad reputation of the early electric light family as a firebug. Quite a little effort was put forth by the electrical manufacturer and his friends and allies to correct the bad impression made by the early history of fires and electrical salesmen were provided with elaborate statistics on fire losses due to the use of coal oil, etc. Special emphasis was laid on the safe character of electricity as an illuminant and this campaign has continued to the present day.

The gas companies and oil companies are resisting every effort made to stigmatize their product as dangerous for fuel or light, but nevertheless through the activity of the electrical inspector, electricity is the only artificial illuminant permitted in portions of the gas or oil plant. This has been possible through the progress of the art in meeting the demands of the rules and their enforcement in connection with lights in rooms containing explosive gases. The list of special devices for these equipments is increasing daily.

As you are doubtless aware, the early apparatus was almost entirely mounted on wood bases, and so-called "underwriters' wire" was the most common conductor used, helped out at times by soft rubber tubing where the wire passed through brick walls or wood floors. The early rules recognized wood-based devices for a number of years and wood cleats for supporting conductors were considered safe for these early installations, and even bare wire was considered safe in engine rooms when supported on woodwork by means of metal straps. The great wonder is that so few fires were caused by these early plants and the only explanation I can offer is that a very high quality of workmanship was employed on the installation work. There was always ample carrying capacity, the splices were carefully prepared and soldered as though for exhibition purposes, the joints in the wood molding were fitted with cabinet-maker precision, the runs were straight and the turns square and the whole job was a work of art, mechanically. It was always a delight to inspect these old installations and it took some courage to condemn them in view of the rather sloppy work that supplanted those old jobs. The product of the modern apparatus builder is a delight to behold as far as mechanical and electrical design is concerned and it is as free from fire hazards as the present state of the art will permit and all through it you will see the effect of the electrical inspector's effort to make the apparatus safe. No one is more glad to have this advice than the machine builder because nothing will hurt him so much as apparatus that causes fires.

The manufacturer of electrical material and fittings has seen his business pass through the same metamorphosis as that of the machine builder. The early fittings caused fires.

The early switches and sockets were poorly designed and indifferently constructed until Underwriters' Laboratories began to apply the rules of the National Electrical Code to switch and socket construction and during the early tests most of those on the market were found to be defective. Under this treatment wood bases began to disappear, the light, soft-metal contacts were eliminated and the slow, uncertain make and break soon gave place to a more certain action and we now have as a result of this work the present line of enduring and efficient switches and sockets.

The first snap switch tested made a beautiful torch and the manufacturer of it instead of being provoked was glad to have the defect brought out and thus enable him to correct it. He early saw the value of rigid tests and rigid inspection, because it meant safety to his line of supplies and therefore to his business.

The first socket tested failed almost immediately and the maker of it at once redesigned it to meet the tests and it has done so ever since. Other manufacturers of sockets followed this good example and the upward trend of the standard began.

The history of rubber-covered wire was somewhat different, because the quality of this product went down before it came up. Thanks, however, to the persistence of inspectors and the co-operation of Under writers' Laboratories with the Associated Manufacturers of Electrical Supplies, this material is now of uniformly good quality.

The fuse situation has been greatly improved. The first fuses were crude wood-based affairs and they

have now given place to the modern porcelain-base Edison plug type fuse almost universally adopted for branch-circuit protection and the cartridge inclosed type for the protection of power equipments. The standardizing of the latter type was brought about by pressure from inspection departments and the general use of the former type was quite largely promoted by inspectors, both through moral suasion and by ordinance enactment and adopted rules.

The early form of primary battery for electric bell work was not satisfactory and many porters and engineers would cut the electric light current on to the bell circuit. Neither the bells nor the wiring were suitable for this current and many fires resulted. The refusal of the electrical inspector to permit this practice forced the consideration of specially designed bells, better wiring and the ultimate production of motor-generators for direct-current signaling and the bell-ringing transformer for alternating-current signaling systems.

Furniture manufacturers and others using glue were heating their glue pots with oil and gas. The night watchman or early morning porter started them so that by the time the men arrived the glue would be ready to use. The man who started these glue pots was not always careful to see that everything was ready before lighting the burners and many early morning fires resulted. The application of the gas heater has been improved and the introduction of the electric heater with its signal lights and special circuit which may be cut off at one point, has quite largely displaced the old oil and gas burners in the modern shops and the fires have been reduced in number. When improperly designed or wired even the electric glue heater becomes a serious hazard and the inspector must see that only approved heaters are used and that they are properly installed.

The tailor shops gave the insurance inspectors much trouble at the time they were equipped with self-heated irons, using gas and oil. The electrical inspector proposed the use of electric irons with signal lights to indicate the presence of current in the iron and helped the situation and now even the laundries are quite generally equipped with them. The inspector has found it difficult to persuade the users of electric irons that irons not in use must be placed on stands designed for the purpose.

The history of the weatherproof socket is interesting. When the first incandescent lights were installed in the packing houses in Chicago it was found necessary to wrap the brass-shell sockets with tape and paint or compound them heavily to make them moistureproof. This was an expensive operation and a cheaper socket for this work was sought. A glass socket was designed with the leading-in wires and exposed screw heads sealed in with a compound of litharge, sealing wax and powdered glass, but changes of temperature soon wrecked them. The second attempt brought forth a socket of molded material which was a temporary help, but it did not please inspectors and the weatherproof porcelain socket was produced and became popular.

Later the inspectors, seeking safety to life, during the agitation of the grounding of secondaries, made a market for porcelain sockets, both key and keyless, for use in basements, bathrooms and where exposed to corrosive vapors. The weatherproof porcelain socket held its own fairly well, except when subjected to rough usage, and to meet this need the composition socket in various forms came into its own again. Of course, there was a need for these sockets, but the inspector must see the need and require the use of the safe and serviceable device or he will not be doing his duty.

The inspector has already done good work in bringing about the safety of utilization equipment, but much yet remains to be accomplished before even reasonable safety is assured. The inspector may do his full duty, and generally does, but he must have the cooperation of the public generally in handling the problem. The public must be made quite thoroughly acquainted with the proper way of using the various electrically operated devices and in this way their use will increase and the hazards diminish.

It might not be amiss in passing to call attention to the fact that rigid inspection in support of the test work at Underwriters' Laboratories and the progressive engineering on the part of the electrical manufacturers has produced a line of electrical materials, fittings and devices which are second to none in the world and with these to work with, the fires of electrical origin should be practically eliminated.

It has only been possible to touch a few of the high spots in pointing out specific instances of the services of inspectors in improving the quality of electrical fittings and material. This is all that is necessary in view of the broad experience each of you has had in this work. You are, no doubt, familiar with the standards, prepared by Underwriters' Laboratories in co-operation with the manufacturers, which provide for the inspection and test of the principal electrical materials and fittings at the factory. The product that is up to standard is labeled and periodically it is examined and tested in the field or samples are picked up in the open market and sent to the Laboratories for test. All of this work goes for naught unless the inspector avails himself of this helpful work and makes it of service to the public by restricting approval to those materials and fittings of known excellence. The manufacturers of electrical machinery and supplies are not slow in acknowledging the vital influence that the inspector of interior wiring exerts on the electrical manufacturing business. They see clearly that without inspection there is no standard and without a standard there is confusion, and confusion strikes at the very foundation of everything it touches.

The Central-Station Man's Estimate.

In the early days, no one joined more enthusiastically with the old-time electrical contractor in fighting inspection under the National Electrical Code than did the old-time central-station manager. He, too, thought he saw his business ruined by the establishment of a standard for wiring which produced reasonable safety from fire, but which, because of compliance with the standard, would cost a little more than the old sort, and he was sure that no one would ever want electricity if the wiring were to cost more. As the purchase of reliable materials and fittings increased the cost went down, and as wiremen became accustomed to the new methods of installation, they were able to do more work, and the cost finally dropped to a reasonable figure and the business went right along as usual.

The improvements in lamps and generating machinery soon cut the cost of current per lamp until it supplanted gas and oil as possible competitors. The central-station man gradually became aware of the many advantages which inspection brought him. As the old and defective wiring was gradually eliminated by inspection, his force of troublemen decreased and the customers stopped "kicking" about the quality of

the service. The cost of renewing sockets and switches was reduced to a minimum. The fuses seldom blew and the lights were seldom out. There were fewer complaints of excessive current bills due to current leakage, brought about by defective material and careless workmanship, and last, but not least, the fires caused by faulty wiring became less and less, and the uneasiness of customers was gradually overcome by a low fire record.

The rigid enforcement of the requirements of the National Electrical Code has a most enthusiastic supporter in the progressive central-station manager, and the better the quality of the inspection of interior wiring, the better he likes it.

The inspector has helped the central station in another way. He has reported many cases of current theft and has helped in many ways to eradicate this dangerous practice.

In a small city, the electric light plant was shut down by some college boys who tampered with the wire. There was no inspector in the town but the manager of the plant wished many times that there was one, if only to protect the service.

Sometimes the plant manager and the inspector "lock horns" over the outside wiring situation, but generally the inspector is right, and if he perseveres and secures the improvements needed, there is no one so happy about it as the plant manager himself.

The central-station man has given his estimate of the importance of inspection of interior wiring by employing inspectors himself, and these men look out for the company's interest as well as that of the prospective customer.

Conclusion.

The business man may do his part in ordering that electric light wiring shall be installed in his building in full compliance with the National Electrical Code; the householder may order that the wiring in his home shall comply with the National Electrical Code; the electrical manufacturer may be ever so careful in the production of suitable material and fittings; the electrical contractor may be particular about instructing his men as to the way in which the work must be done; and the central-station man may have his part of the work well in hand; but it remains for the inspector of interior wiring to see to it that suitable material and fittings are properly used and that the contractor's men employ good workmanship while installing the work, and that the central-station employes make a proper connection to the installation. A failure anywhere along the line may render the whole job useless.

The inspector of interior wiring is the keystone of the arch of the electrical industry, and if he fails to properly perform his duty, or if there is no one to perform such duty, the industry in that locality is in grave danger of collapse because it ceases to have a foundation of safety.

The inspector of interior wiring wields a sharp, two-edged sword and he has handled it with dexterity in most cases for he is the most popular city official excepting in some cases the fire chief. He has gained this popularity through serving the public, and in serving the public faithfully he has hurt no one but has helped all. Heretofore, but one edge of the sword has been used—that which produced safety to property. He is now to be called upon to use the other edge—that which produces safety to life. Will he do as well with the latter as he has done with the former? There is no question but that he will.

REVERSAL OF COMPOUND DIRECT-CURRENT MOTOR UNDER OVERLOAD.

By R. A. Ferguson.

When a compound-wound, direct-current machine reverses itself while it is overloaded it is possible that the shunt field and the compound field are so wound that they oppose each other. That is, they may be differentially wound, as shown at *II* in the accompanying sketch. If such is the case with a motor, as the load increases too much beyond normal full load, the field due to the series winding would increase and might increase sufficiently to "overcome" the field, due to the shunt winding. This would tend to change the direction of the resultant field in the air gap and reverse the direction of rotation of the motor. At *I* is indicated diagrammatically the correct connection for a compound-wound motor that is wound cumulatively, which means so that the shunt and series field mag-

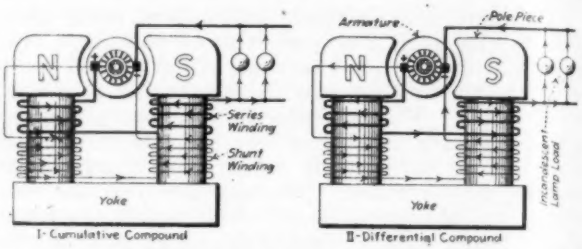


Diagram Showing Cumulative and Differential Compound Windings for Direct-Current Machines.

netizations add or accumulate to produce a stronger joint field; this is the connection commonly used for compound motors operating certain hoists, cranes, etc.

The differential connection is occasionally used intentionally where it is desired to have a direct-current motor operate at almost exactly constant speed regardless of the load. In this case the series field is not very strong and is used to weaken the resultant field as the load increases, which results in increase of speed just as does weakening the field of an ordinary shunt motor by means of the field rheostat; this increase of speed in a differential motor is just sufficient to compensate for the slight drop in speed due to load in the case of a straight shunt motor. Differential motors must be operated with considerable care and are not widely used.

AMONG THE CONTRACTORS.

G. W. Malone, of Cleveland, Ohio, has received the contract for electric wiring of a new public school at Kinsman road and East 146th street in that city.

Buch & Meridith, Harrisburg, Pa., will install the electrical equipment in the new machine shop being erected at Rutherford, Pa., by the Philadelphia & Reading Railway, at a cost of about $45,000.

S. J. Watson, Jr., Hampton, Va., has been awarded a contract by the Government for electrical work in connection with the new hostess house being erected at Camp Stuart, Newport News, at a cost of $60,000.

Roseburg Electric Co., Roseburg, Ore., recently completed the wiring and motor installations in the new plant of the California Packing Corp., which required a load of 30 hp., energy being purchased from the Douglas County Light & Water Co. In like manner, the wiring and motors were installed in the plant of Roseburg Canning Co.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 441.—Costs of Knob and Tube, and of Molding Wiring.—A number of weeks ago there were published in Electrical Review some charts and data showing the cost of conduit wiring. This was the best information of this kind that I have ever seen. My only regret was that there was nothing included on knob-and-tube and molding wiring. If some of your correspondents can present similar information for knob-and-tube and molding wiring I am sure that the information will be greatly appreciated by your readers. —C. T. L., Toledo, Ohio.

No. 442.—Drilling Steel Cabinets and Boxes.—I often get steel panel boxes in which I have to drill holes for additional conduits. This work has to be done out on the job. I have been using big twist drills, but this method is not very satisfactory and is quite expensive. Can someone suggest a better one?—M. D. B., Cedar Rapids, Iowa.

No. 443.—Location of Service Switches.—The Underwriters' rule states that the service switch must be placed in the nearest readily accessible place to the point where the wires enter the building, which I interpret to mean that a separate switch is required for every building. I recently wired a new building, however, in which it was very difficult to decide how to locate the switch. The building was three stories high with stores on the first floor, offices and an apartment on the second and a large apartment on the third floor. The entire building had a frontage of 125 ft., which was divided into three sections. Each of these sections was separated from the others by a fire wall and constituted a building in itself, having separate heating plants, chimneys, etc., with no interior passageways between the sections. The entire building was erected on one building permit and had but one sewer and water connection. I finally decided to install a separate switch and outlet for each section, in order to be on the safe side, although it cost more to do so, but for future reference I would like to know whether I was correct or not.—L. M. C., Baltimore, Md.

No. 444.—Supporting Wires in Vertical Conduits.—In vertical conduit runs the conductors should be supported within the conduit system. I have some work in contemplation where it will be required to support some of these conductors and would like to hear from your readers as to the best ways of arranging these supports.—J. T. O., Newark, N. J.

Answers.

No. 437.—Trolley Feeders.—The outer braid covering of feeder cables for trolley lines has a tendency to go to pieces after a few years, causing the same to hang down in dilapidated condition and affording excuse for complaints of unsightliness along the streets. Would painting or other treatment of the braid prevent this trouble and extend its life? Since trolley wires are bare, why is there any greater need of covering the trolley feeders which are much less likely to fall down?—J. C. N., Seattle, Wash.

Answer A.—There has been no insulated wire or cable produced that will not in time look shabby when exposed to the weather as is street-railway feeder cable strung on poles. Frequent painting with the proper kind of paint would no doubt increase the life of the insulation on exposed wires, but it has been thought that the expense of painting was not justified. It would of course take several years to find out what saving could be made by painting the feeders periodically while in place. No extensive experiments are as yet completed to my knowledge. It is an advantage to have cables which pass along streets where there are trees insulated instead of bare. Persons may be injured by coming in contact with the bare wire—persons who have proper business climbing the trees. Considerable annoyance and damage may also be caused by leakage of current to wet branches on coming in contact with bare charged wires. The National Electrical Code, Rule 12 *a*, states that line wires must have an approved weatherproof or rubber insulating covering. This would no doubt apply to feeders run above public highways. If the railway is on a private right-of-way, there should be no objection to bare feeders. If the insulation is already in shreds, the most obvious course to pursue is to replace the cable with new cable, using the old in some other way or scrapping it.—S. H. Anderson, New York City.

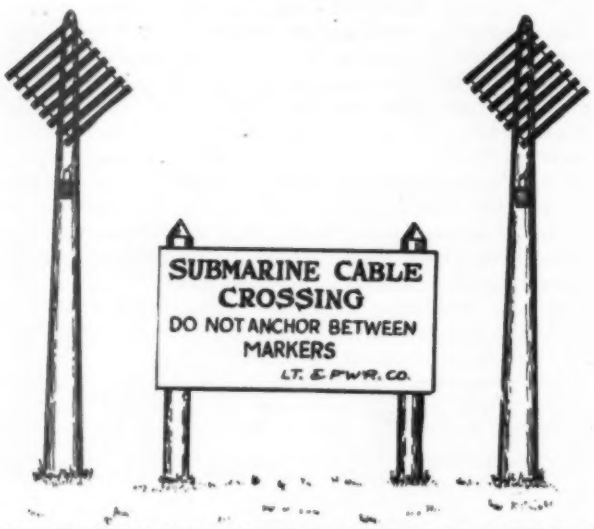
Answer B.—To insure perfect and unbroken contact between trolley wheel and wire, the trolley wire must naturally be uncovered. However, to prevent leakage losses and short-circuits the line feeder must be thoroughly insulated from all surrounding bodies. The insulating covering on trolley feeders performs several functions: (1) Protects linemen from shock or burns while working on other lines on the same pole; (2) prevents possible crosses with lines on the upper arms which become broken and hang down onto the feeders; (3) tends to prevent leakage losses through trees, sometimes even through the poles themselves, and other places with which the feeder may come in contact. With the use of bare conductors these losses by leakage would be enormous in damp periods, and considerably greater in dry periods, than when the insulating covering is used; the only way to avoid this would be to use high-tension insulators on crossarms, special tree insulators, etc. In the writer's opinion, the unkempt appearance of many large wires or cables is due to improper care in handling during the line construction. To improve this unsightliness I would suggest that all loose ends be cut away and any places not bad enough for removing, being sewed or wound with sewing-twine, which should afterwards be painted with weatherproof paint. To prevent the braid from loosening at points other than those under repair it would be well to paint over the entire line, using ladders or cable-cars for this purpose, depending upon the size of the line.—W. F. P., Atlantic, Mass.

Answer C.—Treatment does very little good, not enough in fact to warrant its use. Trolley feeders were insulated in the early days to make the public feel safe and no one has taken the trouble to educate the public. On lines of 10,000 volts or more it is common practice to omit insulation, as the insulation does not give safety but causes people to take big chances because the wire is covered, which gives a false sense of security. Bare wire could and should be used for all circuits over 300 volts where run open as on poles. Public service commissions are allowing bare feeders and the courts are learning that insulation does not contribute to the safety from circuits above a few hundred volts, so that there is little to fear in law suits.—H. E. W., Chicago, Ill.

No. 440.—Submarine Cable to Island.—Current for electric light is to be supplied to an island about one-half mile from shore. The intervening channel is navigable and is used as a shelter harbor. What is the best way to protect the submarine cable supplying the island so that it will not de damaged by dragging anchors of boats anchored in the channel harbor?—T. R. P., Pensacola, Fla.

Answer A.—The safety of the submarine cable lies wholly with two persons—first, with the owner or

operating company in the method in which notice is given of the cable's presence and, second, with the mariner and the manner in which he regards such notice. In the opinion of the writer there is but one method of satisfactorily notifying the mariner of the cable, and that is by means of a sign set at each shore end of the cable. This sign must be of such dimensions as to make it legible for some distance from the shore. To be discernible at such a distance black lettering on a white background would be necessary. The construction, supports and bracing for such a sign would depend entirely upon weather conditions. Where the bay is used as a shelter-harbor the sign alone would be insufficient, as often during heavy storms, vessels drag their anchors for long distances, doing much damage to anything which they run afoul of. This feature can be overcome partly by erecting a range marker at some considerable distance to each side of each sign-board. The spacing between sign



No. 440.—Shore Marker Cautioning Mariners on Location of Cable.

board and markers would be judged from the severity of winds and tides. This gives the boat crew a greater chance to stop the progress of their vessel (in case the anchor drags) and thus prevent possible damage to the cable. The markers should be of such size as to be easily seen from shore to shore of the bay. They should be of latticework construction and so painted, black or white, as to stand out against the existing background. At night the locations of these markers could be shown by equipping each one with a Fresnal glass lens lantern, the lens being of such color as to be readily identified and not conflict with other markers which may be in close vicinity. The lanterns could be connected to the lighting circuit and the required safety devices through wires in the cable. The installation of time switches would save the expense of a patrolman. The accompanying sketch will give an idea of details not fully described.—W. F. P., Atlantic, Mass.

Answer B.—No absolutely reliable way has been devised for safeguarding a cable under such conditions. Where the bottom of the channel is sand, loam or clay it may be possible to dredge a narrow continuous trench, say, about one yard deep and approximately two feet wide clear across the channel to receive the cable. If this dredging can be done shortly before the cable is laid into the trench, the latter will gradually fill itself by action of the waves and water currents, thus fairly well protecting the cable. The only objection to this, aside from the cost of dredging, is that it will make it difficult to take up the cable for repairs or to reclaim it if no longer needed.—C. R. M., Charleston, S. C.

EFFECTING FUEL AND LIGHT ECONOMIES IN ENGLAND.

Suggestions for Preventing Waste by the Steam Power Users Among British Factories.

With the co-operation of his army of electrical and other experts, the British Coal Controller has prepared for the assistance of power users in munition and private steam-using factories, several series of practical suggestions for effecting economies in fuel consumption. One of the series shows that in some of the midland centers of England munition works have prevented leakage and excess consumption in the following ways:

(1) A careful grading of illumination to suit various classes of work.

(2) Abolition of local lighting for separate machines and the substitution of general lighting with suitable reflectors and larger units, such as the "half-watt" metal-filament lamp and mercury-vapor lamps.

(3) A systematic patrol of the works to ensure that no unnecessary lights are kept burning.

(4) Appointment of economy engineers whose sole duty is to supervise the operation of plant to secure the most economical results.

(5) Periodical relining of shafting to reduce power consumption.

(6) Burning of sawdust under steam boilers. (One works saves 600 tons of coal a year by this substitution.)

(7) Keeping down the temperature of workshops. (In one well-known establishment the temperature is fixed at 55 deg. F.).

The 400 experts of the Coal Controller are consulting with and advising steam power users how to eliminate waste. A large number of these experts being thorough electrical engineers, the advantages of electricity will not be forgotten, but apart from that aspect of the subject, ways are indicated by circulars in which fuel users may effect saving without any alteration to their existing plants (alterations cannot be effected at present, of course). These ways are:

(1) Obtaining greater efficiency in the combustion of fuel.

(2) Education of stokers.

(3) Utilizing the heat in the gases to better advantage.

(4) Using exhaust steam for heating feed water.

(5) Adjusting engines to more efficiently use the steam generated.

(6) Using the hot water from the condenser discharge for boiler-feed purposes instead of cold water.

(7) Effective lagging of steam pipes.

(8) Disconnecting steam pipes not in use.

There are 45,000 users of steam plants in Great Britain. The experts have investigated the operation of 364 of them and they estimate that from these alone it should be possible to secure a saving of 106,000 tons. The employment of unskilled stokers has always been a cause of great waste, and at present, owing to the absence of so many men of this class with the armed forces, things are far worse in this aspect than normally.

New Appliances

Combined Boiler and Washer—Portable Duplex Indicating Instruments—Vertical Generators for Hydroelectric Plants

NEW ALMETAL ELECTRIC WASHER.

A new electric machine designed to further eliminate the labor attached to washing clothes has recently been put on the market by the Manufacturers Distributing Co., 400-6 Fullerton building, St. Louis, Mo. It is called the "Almetal household steam laundry" and embodies several new and novel features. Special attention was given to provide means to conserve even some of the labor attached to washing as done with other electric washers.

View of Almetal Washer with Part Broken Away to Show Interior Construction.

As seen from the illustration, the body of the machine is very different from the usual style, requiring less floor space and being easier to move. A gas burner is placed under the water container which heats the water in the machine and keeps it hot as long as it is needed. This does away with moving the hot water from the boiler to the machine, a tiresome and difficult job and one from which many burns are received.

The vacuum and pressure system, combined with heat, is used to force the steam and bubbling, boiling soapy water back and forth through the clothes, cleaning, sterilizing and bleaching them thoroughly at the same time. This is done by the up-and-down movement of the cup working through the cover, which is operated by the motor at the bottom of the machine. The wringer is also operated by the motor and is arranged so that it can be swung and operated in any position. The clothes are laid on a pan attached to the cover by chains so that the clothes are lowered into the water when the cover is closed and lifted out of the hot water when the cover is raised. This saves putting the hands into hot water or fishing for the clothes with a stick.

The entire action of the machine is very gentle but effective so that it washes even the most delicate clothes without tearing. It is also rapid, washing six sheets or equivalent in from 5 to 20 minutes. This quite effective work is obtained because the machine is a veritable steam laundry on a small scale. Practically all parts of the machine are built of metal and the entire outfit is durably, neatly and safely constructed.

ESTERLINE DUPLEX INDICATING INSTRUMENTS.

For many purposes in general testing and locating of trouble in power installations it is necessary to have available a portable instrument of considerable accuracy and of the greatest possible compactness. A line of instruments to meet this requirement has been placed on the market by the Esterline Co., Indianapolis, Ind. These are designated as the Esterline Type W duplex indicating instruments and include a number of very important new features in construction which gives them additional interest.

The instruments are designed primarily for use in alternating-current work but also can be used for direct-current testing with slightly lower accuracy.

Esterline Type W Duplex Indicating Instrument.

The instruments are of the electrodynamometer type and are arranged so as to combine two instruments in one case. For that reason the moving system has two independent metering elements mounted upon it, one of these serving, say, as a voltmeter and the other as an ammeter. The moving system has a number of unique features, one of which is that it is carried by a steel suspension wire which acts both as a support and also as the spring for returning the moving coils back to zero. The two moving coils are formwound and impregnated and coated with a clear transparent Bakelite insulating compound, which when set is very hard and firm, accurately maintaining the coils in proper shape and relation and at the same time protecting them from changes in atmospheric conditions.

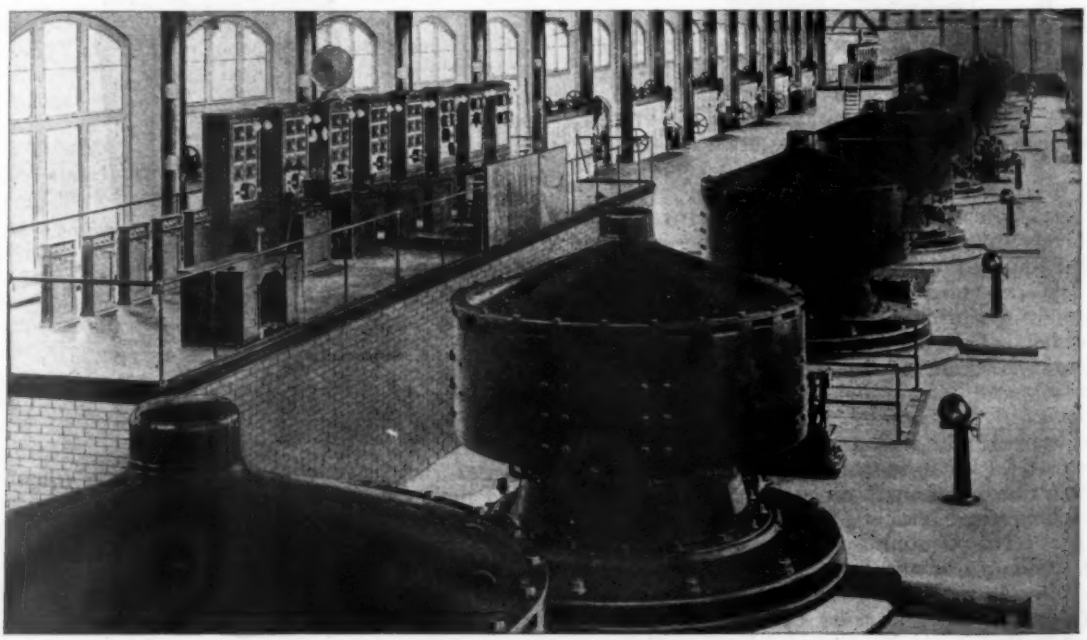
The wire that supports the moving system is a carefully heat-treated steel suspension wire which also acts as the restraining element; this construction does away entirely with the use of hair springs, jewels and pivots. The upper end of the suspension wire is elastically supported so that even should the instrument be dropped the suspension wire and moving coils will not be strained. This makes the instrument very rugged and especially suitable for ordinary portable use involving considerable rough handling. Another feature in which the instrument is novel is in the use of machined cast aluminum frame and top plates. For damping there is provided an adjustable oil damper designed to be unspillable and in every way practical. The stationary coils of the instrument are formwound, carefully taped and impregnated with a high-temperature insulating compound so as to withstand continually an overload of 50%. The instrument is tested when completed at a potential of 1100 volts between the various current-carrying parts and the frame.

The two moving coils are mounted on one moving element which has a single needle that moves over a scale, comprising an arc of 60°. This scale is 5 in. long and is divided into divisions, which in the case of a wattmeter are almost exactly of uniform length; in the case of voltmeters and ammeters the lower portion of the scale is slightly crowded but the working portion is well spread out and easily read. The scales for the two parts of the instrument comprising one set are arranged on the opposite sides of the mirror, the latter being provided to prevent parallax in making a reading. A zero-shifting device is provided to enable the pointer to be readjusted to zero in case the zero point is shifted for any reason. The instruments are provided with a suitable shield to protect them from outside magnetic fields, which consists of a light, soft casing rigidly secured to the inside of the case. The latter is made of mahogany and provided with nickel-plated brass corner-protecting pieces and with a strong set of hinges and lock. A heavy leather carrying strap makes the instrument convenient to handle.

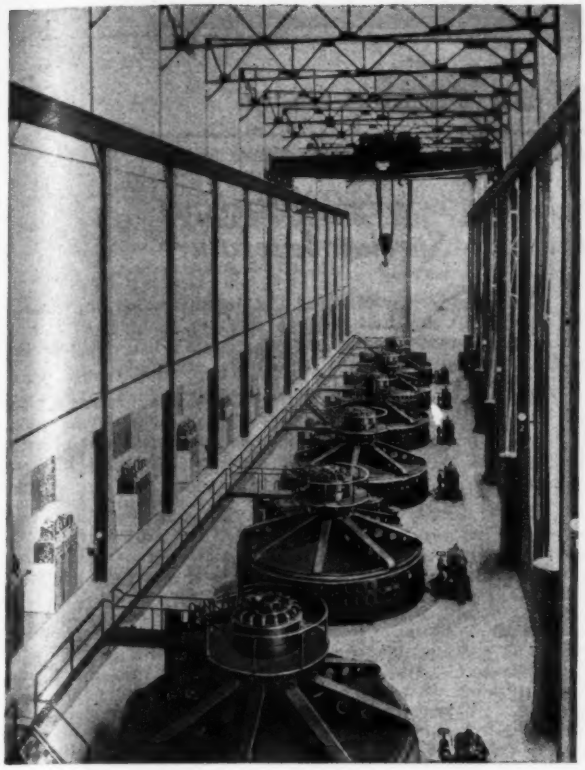
When used in alternating-current testing, the instruments are accurate to within one-half per cent of the full scale value at any point within the working range of the instrument. These being duplex instruments, they are made so as to include the following combinations: voltmeter and ammeter, single-phase wattmeter and voltmeter, single-phase voltmeter and ammeter, and polyphase wattmeter, the latter including of necessity the two moving coils in a single instrument. The voltmeter and potential circuits of the wattmeter can be obtained with ranges of 150, 300, 500 and 750 volts. The ammeter and current circuits in all cases are designed for five amperes. The entire instrument is compact and light, considering that it consists of two instruments in one; its weight is about 10 lb.

WESTINGHOUSE VERTICAL GENERATORS FOR WATER-WHEEL DRIVE.

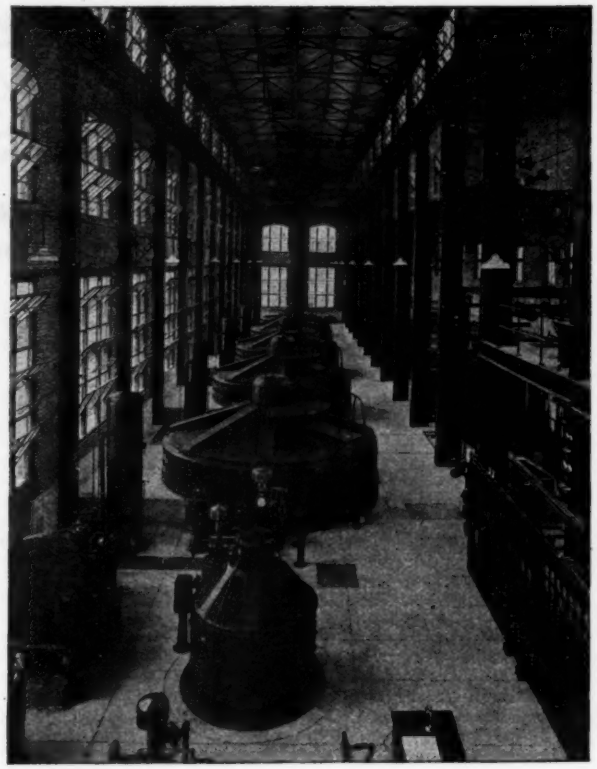
Present-day fuel and labor shortages, with their consequent increased costs, are going to be instrumental in the promotion of many new hydroelectric developments. Of our 55,000,000 hp. of unused water resources, a great many thousands can be developed economically to meet the existing requirements for electrical power, and these will be a material factor in the conservation of our fuel, and towards the elimination of railroad congestion and car shortage. Legis-



The First "Hydro" Plant in America, Started in 1895 and Still Going—Niagara Falls, N. Y.



Six 14,700-Kva., 6600-Volt Generators Serving the Electrochemical Center of Canada, Quebec, Can.



Five 2700-Kva., 2300-Volt Units for Cotton Mills and General Power Purposes at Augusta, Ga.

lation favorable to such development is to be expected of our national and state lawmakers. The prospect of renewed activity in water-power development calls attention to the developments in electric generators for hydraulic plants made by one of the leading manufacturers of such equipment.

In 1895 the Westinghouse Electric & Manufacturing Co. built the generators for the first large hydroelectric station in America, that at Niagara Falls, and it has manufactured many hundreds of machines at its plant in East Pittsburgh, Pa., since that date. Today these units are furnishing, economically and reliably, light for our homes, our factories and our cities, power for our mills, our mines and our networks of railroad lines.

We of America expect high efficiency from our people and from the machines which they manufacture. To utilize our water powers to the best advantage, water wheels and generators must both be designed to meet the conditions imposed by nature. These conditions vary widely, and the range in capacity and speed encountered demands an equally broad experience.

Single-runner vertical wheels of exceptionally high efficiency are now available for at least all of the low and medium-head developments, and it is to be expected that the majority of our future installations will be of this type. The success of the vertical type depends on the satisfactory operation of the thrust bearing carrying the weight of the revolving parts.

Proposed governmental legislation seems to have determined 50 years as a reasonable period for water-right leases. Whether electrical apparatus will last this long remains to be seen, the art still being considerably less than 50 years old and obsolescence so far being responsible for far more scrapping of material than wear and tear. Certain it is, however, that today no manufacturer is justified in counting on obsolescence for protection, and only those materials which will wear the longest should be employed in the building of water-wheel generators.

One of the most frequent causes of generator shutdowns has been, and probably will be, failure of the armature insulation. By a happy choice, Westinghouse engineers early decided on mica, a material which does not age, which is unaffected by temperatures far higher than those found in the modern, well-ventilated generator and which remains unimpaired under the static discharges common to all high-voltage machines. Efforts have been directed for many years to the perfection of methods in the application of this material as armature coil insulation. Proof that its early choice was a most logical one is found in the increasing use of this material by all electrical manufacturers building large-capacity and high-speed machines.

The danger of runaway speeds, 50 to 100% above normal, is ever present in the hydroelectric plant, and a rotor construction which safely withstands the stresses incident to this abnormal condition is essential. No single type of construction will cover with safety and economy all the range of capacity and speed encountered. Cast iron is satisfactory only for rotors of low peripheral speed, where steel castings, if of very large size, may not be sufficiently uniform in strength to rely on. Laminated steel rims and rolled steel plates are sometimes resorted to for high-speed service. Successful types of construction to fit each and every case have been designed and thoroughly tried out.

With a completed product made up of so many small but essential parts, careful inspection and test is desirable. Each operation during the process of manufacture is carefully inspected, all materials employed are properly tested and, whenever feasible, the finished machine is given a running test under conditions closely approximating those of normal operation.

Trade Activities

Change in Monarch Refillable Fuse Personnel—Esterline Company Appoints Representatives—Special Literature

Diamond Power Specialty Co., Detroit, Mich., recently furnished to the municipal electric light and power plant of Cleveland, Ohio, an equipment of Diamond soot blowers valued at $3747.

Meadows Manufacturing Co., Pontiac, Ill., finds it difficult to keep up with the demand for its washing machines. This company's washer is meeting with great favor and the shops are being taxed to their utmost. This machine has been on the market for many years and several recent improvements have no doubt added to its popularity. The company will be glad to send its attractive selling-plan to dealers in unoccupied territory who may be interested in handling a reliable electric washer.

Locommotive Pulverized Fuel Co., 30 Church street, New York City, has received an order from Morris & Co. of Chicago for equipping its steam power plant at Oklahoma City, Okla., with its complete "Lopulco" system for crushing, drying, pulverizing and burning coal. The Morris company expects to use native coals and to make use of Texas lignite. The power plant contains seven Edgemoor boilers, having a total of 3100 hp., all of which are to be equipped. This is a notable installation in a large meat-packing plant.

Electric Storage Battery Co., Philadelphia, Pa., in a new edition of Section V and Price List V, just issued, lists the Exide, Hycap-Exide and Thin-Exide batteries for electric vehicles. Section AB, second edition, covering the Chloride Accumulator and Tudor Accumulator is also a recent revision of its catalog series and lists these batteries, which are extensively used in various classes of storage battery service. Copies of these publications will be furnished upon application to any of the sales offices of the company or to the general offices in Philadelphia.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., recently issued two leaflets, illustrating and describing C-H soldering irons and C-H automatic safety racks for electric soldering irons. These leaflets are known as Publications 403 and 404. The former enumerates the advantages secured through the use of an automatic safety rack. This rack keeps the iron at a safe temperature between periods of use; allows full current to flow as soon as the iron is lifted from the rack; insures against fire and waste, and speeds up work. The latter leaflet points out that war time work requires efficient tools and as such, the electric soldering iron consumes no fuel or current, except when in actual use; does not vitiate the air; is safe for both the experienced and inexperienced employe, and reduces fire hazard. It is believed that this ingenious device, which was described in a recent issue of the ELECTRICAL REVIEW, will greatly extend the use of electric soldering irons.

The Esterline Co., engineer and manufacturer of graphic meters, permanent magnets, etc., Indianapolis, Ind., announces the appointment of the Electrical Sales Engineers, Inc., 19 South Wells street, Chicago, as its exclusive representative for northern Illinois and Indiana. The Electrical Sales Engineers, Inc., is managed by Paul W. Koch, who has had a number of years' experience in the electrical field. He has made a special study of the construction and use of Esterline graphic instruments, and is well qualified to give any assistance or information in connection with metering problems. The Esterline Co. has also completed arrangements with the C. B. Fall Co., 2046 Railway Exchange building, St. Louis, to act as its exclusive representative for the state of Missouri and southern Illinois. Mr. Fall, president of the above company, is an experienced meter man, having received his early training in the laboratory of the Esterline company, and for a number of years was in charge of meters and testing for the Indianapolis Light & Heat Co. He thoroughly understands the use and construction of Esterline instruments.

Wellman-Seaver-Morgan Co. is furnishing the charging equipment for the open-hearth steel furnaces of Pacific Coast Steel Co., Seattle, by which 7000-lb. charges will be expeditiously handled by electrical equipment.

Main Electric Manufacturing Co., Pittsburgh, Pa., has issued a new price list covering items appearing on pages 19, 23, 25, 27, 31, 32, 33 and 35 of Catalog 100 of electric light plants, effective Nov. 1. Revised prices on engines and oak leather belts are also listed.

H. W. Sharp & Co., northwest agents at Portland, Ore., for Scandinavia Belting Co., New York City, lately sold to Portland Gas & Coke Co., 200 ft. of 36-in. conveyor belting, which was installed in the latter's coal briquetting plant at Gasco, near Portland.

Altorfer Bros., Peoria, Ill., makers of the "super-electric" washing machine, report an unusual demand for their product. This firm has brought its machines to the highest point of perfection and states that they are very popular. Electrical dealers, jobbers, and contractors have found the "super-electric" a paying adjunct to their business. Requests for territory are constantly being received by the company.

Art Metal Construction Co., Inc., Jamestown, N. Y., is sending to architects, engineers, manufacturers, contractors and builders its booklet, entitled "An Improved Method of Planfiling." This describes the steel file made by the company for the vertical filing of drawings, tracings, blueprints, etc. This file is made of great strength, is very compact, and is practically fireproof. It permits taking out any drawing very quickly and the drawings, being always hung vertically, are straight and free from creases and folds. Several other types of filing cabinets are also described.

Monarch Refillable Fuse Co., 660 Ellicott Square, Buffalo, N. Y., announces the appointment of L. I. Geyer, of Buffalo, as assistant manager of the company. Frank H. Kaiser, who has been connected with the company since its organization, has disposed of his interests and is no longer connected with this concern. The Monarch company has also engaged the services of Prof. J. F. Putnam, of the electrical laboratories of Cornell University, as consulting engineer. He is well and favorably known in his profession and under his supervision every problem that the production of a satisfactory fuse presents will unquestionably be solved and the Monarch fuse will thus retain its position as one of the best and simplest fuses manufactured today.

American Washing Machine Manufacturers' Association, Chicago, has issued for the benefit of its members a very instructive booklet entitled "Who Washes Your Clothes," which presents in a very forceful manner the many arguments in favor of the washing machine. It tells the story of one of the modern practical devices built to save time, labor, money and health in the average household and solves in a large measure the servant problem in rural and country homes, which is daily becoming more acute. The booklet includes the summerized reports of various investigations of laundries made by health departments which bring out some interesting facts. Sanitary conditions existing in the average "hand laundry" have been found to be of a very low grade and facilities are limited and of a very primitive type; methods employed by steam laundries in the collection and delivery of clothes are found to be defective in many respects in a considerable proportion of the laundries, and on the whole conditions are very little better in the steam laundries than in the so-called hand laundries. Health authorities urge that for sanitary reasons, if for no others, the clothes be washed and ironed in the home, and thus remove the danger from infected linen when washed in laundries. This booklet is being distributed by the individual manufacturers with their imprint.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

MANCHESTER, N. H.—Stark Mills have awarded a contract to the McNally Building Co., Framingham, Mass., for the construction of a new pumping plant at its works.

WORCESTER, MASS.—Rockwood Sprinkler Co., 56 Harlow street, has completed arrangements for the construction of the proposed one-story boiler plant at its works, about 50x70 feet.

LEESVILLE, CONN.—Central Connecticut Power Co. has completed arrangements for the erection of a power house addition to its local plant, to provide for increased capacity. Jenks & Ballow, 735 Grosvenor building, Providence, R. I., are engineers.

NEW LONDON, CONN.—The United States Government, Bureau of Yards and Docks, has awarded a contract to James Miles & Son, Worcester, Mass., for the construction of two subcharging stations at the local navy yards, to cost $16,837.

ALBANY, N. Y.—The Public Service Commission is planning to hold the formal hearing of the application of the Niagara Falls Power Co., the Hydraulic Power Co. and the Cliff Electrical Distributing Co., Niagara Falls, for approval of an agreement of consolidation into one company, issuing $26,000,000 in common and preferred stock.

BUFFALO, N. Y.—Erie Electric Welding Co. has filed notice with the secretary of state of the dissolution of the company.

LYONS, N. Y.—Fire recently destroyed the local plant of the Niagara, Lockport & Ontario Power Co., the total loss being placed at approximately $200,000. It is said the company will rebuild the destroyed works at once.

AMSTERDAM, N. Y.—The Public Service Commissioner Ervine has been permitted to construct an electrical plant in a portion of the town of Amsterdam.

NEW YORK, N. Y.—The Board of Managers of the Roosevelt Hospital, Ninth avenue and Fifty-ninth street, has had plans prepared for the construction of a one-story boiler plant, about 30x30 feet, at the institution. Moore & Landsiedel, One Hundred and Forty-eighth street and Third avenue, are architects.

NEW YORK, N. Y.—Car Lighting & Power Co., 61 Broadway, has been awarded a contract by one of the allied nations for electrical work in connection with a number of torpedo boat destroyers.

OGDENSBURG, N. Y.—Ogdensburg Power & Light Co., 1 Ford street, is considering plans for the construction of a two-story brick administration building on Ford street near Catherine street. The structure is estimated to cost $10,000. Williams & Johnston, 40 Ford street, are architects.

TONAWANDA, N. Y.—In connection with the large local plant to be erected by the Pierce Arrow Motor Car Co., of Buffalo, on the River Road, contract has been awarded to the J. W. Cowper Co., Fidelity Bank building, Buffalo, for the construction of a boiler plant for operation.

RICHMONDVILLE, N. Y.—Great Bear Light & Power Co., under an order of the Public Service Commission, is authorized to transfer to the village of Richmondville its entire lighting system and plant east of the Otsego County line and the rights and franchises heretofore granted to it by the town and village of Richmondville.

BLOOMFIELD, N. J.—General Electric Co., Sprague Works, has awarded a contract for the construction of the proposed new grid and pattern shop, about 60x163 feet, to cost $50,000. The Salmond Brothers Co., 526 Elm street, Arlington, is the contractor.

BOONTON, N. J.—Radium Luminous Material Corporation, which occupies one of the Jersey Corporation buildings, has made application for 450 kw. for electric furnaces and 50 hp. for machine work. This company manufactures radium luminous material for watch dials, used for military wrist watches, compass dials for aeroplanes, etc., and also steel alloy works; 95 per cent of its output is for the Government.

FREEHOLD, N. J.—The Board of Public Utility Commissioners has granted approval to the application of the Monmouth Lighting Co. to increase its rates for service. A war surcharge of 25 per cent will be placed into effect for retail power consumers, while a new schedule will be arranged for large consumers.

NEWARK, N. J.—Oxweld Acetylene Co., Frelinghuysen avenue, is making rapid progress in the construction of a new extension to its local plant to cost about $50,000.

NEWARK, N. J.—Sundh Electric Company, 51 East Forty-second street, New York, has filed notice of authorization to operate a plant at 209 Parkhurst avenue. William E. Quimby is local representative.

NEWARK, N. J.—Maas & Waldstein Co., 437 Riverside avenue, has awarded a contract to Henry M. Doremus & Co., 36 Orange street, for the construction of a power house on Avenue R, to cost $16,500.

TRENTON, N. J.—White City Electric Co., an Illinois incorporation, has filed notice of authorization to operate at 52 Wall street. Edward M. Spears is local representative.

WEST ORANGE, N. J.—The patriotism of employes of the Edison interests has been demonstrated in more than one way in the past. The works of the Edison Storage Battery Co. have been operating at capacity for the production of storage batteries to be used in air service, and the employes of this company have been working voluntarily on recent holidays.

CETRONIA, PA.—Haines Brothers have recently completed the erection of a new one-story brick addition to their plant, to be used as a power house for works operation.

EAST PITTSBURGH, PA.—Westinghouse Electric & Manufacturing Co. is having plans prepared for the construction of a three-story building, about 64x70 feet, at its local plant.

EASTON, PA.—Pennsylvania Utilities Co. has filed notice with the Public Service Commission of the issuance of notes for $115,000, a portion of the proceeds to be used, it is understood, for extensions.

EMPORIUM, PA.—The United States Government, Construction Division, is considering the erection of a new 1000-kw. connection with the construction of the large new sulphuric acid plant.

HARRIMAN, PA.—Merchants' Shipbuilding Corporation has awarded a contract to the Easton Gas & Electric Co. for the construction of an electric power plant at its local works, for operation.

HARRISBURG, PA.—The city is planning to commence work at once on the installation of the proposed new police and fire alarm systems. Clark E. Diehl is city electrician.

PHILADELPHIA, PA.—Philadelphia Electric Storage Battery Co. has awarded a contract to F. & E. Aubel, 2503 Germantown avenue, for the erection of two one-story buildings, about 40x118 feet, and 30x40 feet, to be located at Ontario and C streets.

RUTHERFORD, PA.—Philadelphia & Reading Railway Co. has awarded a contract to Daniel H. Hunter, Reading, for the construction of a new one-story concrete air compressor building at its local shops, about 30x65 feet.

SHARON, PA.—Savage Arms Corporation has awarded a contract to Stone & Webster, 120 Broadway, New York, for the erection of a one-story and basement power plant at its local works, about 87x88 feet in size.

THROOP, PA.—Price-Pancoast Coal Co. will erect a $75,000 electric plant at Throop, Pa. Address John R. Bryden, general manager, Board of Trade building.

BALTIMORE, MD.—Bartlett-Hayward Co., Scott and McHenry streets, has awarded a contract to Morrow Brothers, Fidelity building, for the con-

struction of a boiler house, about 48x54 feet, at Columbia avenue.

WASHINGTON, D. C.—Chesapeake & Potomac Telephone Co. has awarded a contract to Frank L. Wagner, Washington, for the construction of a coal storage vault at its plant to cost $10,000.

WASHINGTON, D. C.—The Emergency Fleet Corporation is considering the substitution of electric welding for the riveting system now in use in connection with the construction of ships of various types, due to the saving of about three-fourths in time and labor. The corporation has issued orders to the Federal Shipbuilding Co., Kearny, N. J., to construct by electric welding a 42-foot midship section of a 9600-ton ship now being built by the company.

ALEXANDRIA, VA.—In connection with the large new local naval torpedo assembly plant to be erected by the Government, contract for which was recently awarded to the Fleischman Construction Co. of New York at $1,075,000, five large electric elevators will be installed in connection with other electrical equipment.

RICHMOND, VA. — Considerable new electric machinery will be required by the Southern Oil Products Co., recently incorporated, in connection with its new plant for the manufacture of castor oil.

ROANOKE, VA.—W. D. Hardy, 728 Tagewell avenue S. E., will install a grist mill to be operated by electricity.

CHARLESTON, W. VA. — West Virginia Water & Electric Co. will supply electric power to the Naval Ordnance Plant at South Charleston.

CHARLESTON, W. VA.—West Virginia Water & Electric Co. has awarded a contract to the Charleston Concrete Construction Co., Charleston, for alterations and improvements in its plant, to provide for increased operations. It is proposed to supply electric energy to the naval ordnance plant at South Charleston.

CHARLESTON, S. C.—Charleston Consolidated Railway & Lighting Co. has awarded a contract for improvements to its plant to the J. A. P. Crisfield Contracting Co., to cost approximately $750,000. The new improvements will double the present capacity of the Charlotte street electric generating station as well as the transmission system, etc.

NORTH CENTRAL STATES.

CLEVELAND, OHIO.—Cleveland Welding & Manufacturing Co. has taken out a permit for the foundation of a power house 100x80 ft. in size. The Hunkin-Conkey Construction Co. has been awarded the contract.

CLEVELAND, OHIO. — Willard Storage Battery Co. will erect a two-story warehouse 35x205 ft. in size at a cost of $50,000. Gaylord W. Feaga Co., Citizens Bank building, is the contractor.

MANSFIELD, OHIO.—The council will improve electric fire alarm system. Address city auditor.

MASSILLON, OHIO.—Massillon Electric & Gas Co. will construct an addition to its present structure in South Erie street. The material is on the ground and work will be started as soon as enough employes can be obtained. The addition will cost between $35,000 and $40,000 and will be constructed of brick, steel and concrete.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York City, December 3-6. Secretary, Calvin W. Rice, 29 W. 39th street, New York, N. Y.

American Institute of Consulting Engineers, Inc. Annual meeting, New York City, January 13, 1919. Deputy secretary, B. Etchelle, 35 Nassau street, New York City.

Northern White Cedar Association. Annual meeting, Milwaukee, Wis., January 21, 1919. Secretary, N. E. Boucher, 702 Lumber Exchange, Minneapolis, Minn.

Western Association of Electrical Inspectors. Annual meeting, Chicago, Ill., January 28-30, 1919, Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

SANDUSKY, OHIO.—Sandusky Gas & Electric Co. has closed power contracts with the Esmond Dairy Co. for 135 hp., also the Pringle Barge Line Co. and the Easiest Way Manufacturing Co.

GALENA, ILL.—Interstate Light & Power Co. (subsidiary of Northern States Power Co.) is making arrangements for two extensions to the Government acid plants at Cuba City and New Diggings, and for running the Mineral Point extension into the Platteville substation.

APPLETON, WIS. — Langstadt-Meyer Co. has leased the building formerly occupied by the Appleton Motor Car Co. and will install new equipment for the production of direct-connected electric generating units for shops and farm purposes.

MILWAUKEE, WIS.—Plans for the construction of a new power plant to be erected by the Milwaukee Electric Railway & Light Co. are being made because of the increasing demand for power.

MINNEAPOLIS, MINN.—The Capital Issues Committee has authorized the Northern States Power Co. to sell a large block of first and refunding mortgage 5 per cent gold bonds for additions and improvements. The Northern States Power Co. operates electric light and power, gas, steam heat and other utility properties in Minneapolis, St. Paul, and 170 other communities in Minnesota, Wisconsin, Illinois, North Dakota, South Dakota and Iowa. R. F. Pack, general manager, 15 South Fifth street, Minneapolis.

MINNEAPOLIS, MINN.—Sales department of Minneapolis General Electric Co., during the week ended Oct. 18, accepted 399 new electric light and power customers with 227 kw. of lighting and 115 hp. in motors. New business connected to the company's lines includes 132 customers with 62 kw. of lighting and 133 hp. in motors. Electric energy output was 8.1 per cent greater than for the corresponding period a year ago.

WORTHINGTON, MINN.—Engineers Charles L. Pillsbury Co., 805 Metropolitan Life building, Minneapolis, have completed plans for addition to the electric lighting plant. Owner, City of Worthington. Address W. H. Buchan, city clerk.

ALTENBURG, MO.—Altenburg Light & Power Co.'s plant was destroyed by fire last week. Mr. Liembach, who bought the plant last spring, sustained a serious loss.

KANSAS CITY, MO.—Kansas City & Leeds Railroad Co. proposes to build an interurban electric railway from 31st street and Hardesty avenue southeast several miles to Leeds, Mo., and the Municipal Farm, and later make an extension to Lees Summit. The plan includes a 100-ft. driveway to Leeds. W. E. Winner, president of the Union Mutual Developing Co., 415 Dwight building, is interested.

MARYVILLE, MO.—Due to the cost of upkeep and all kinds of materials, the light company has increased its rates.

MARSHFIELD, MO.—Election will be held Nov. 8 to vote on a bond issue of $15,000 to purchase the electric light plant.

MONROE CITY, MO. — G. W. Schweer, of Winsor, has taken over the leading interest in the Mutual Telephone Co. The officers of the company are: President, G. W. Schweer; vice-president, H. J. Riley, and secretary and manager, E. W. Schweer.

ST. LOUIS, MO.—Key Boiler Equipment Co. has filed notice of an increase in its capital from $30,000 to $120,000, to provide for expansion.

SLATER, MO.—Bonds to the amount of $25,000 for electrical improvements were voted on Oct. 29.

GLEN ELDER, KANS.—Glen Elder will connect with the power plant of the Kaull Milling Co., and will furnish light and power to its citizens.

ST. JOSEPH, MO.—Contract for electrical work in the new store building of the Townsend & Uberrheim Clothing Co. has been awarded to the American Electrical Co., of St. Joseph.

LEBO, KANS.—The power plant of the Lebo Light & Power Co. burned recently. This plant furnished power for the elevator and the city's lighting system. Arrangements probably will be made to have a line run from Emporia to furnish the town with electricity.

SOUTH CENTRAL STATES.

CHESTNUT GROVE (R. F. D. from SHELBYVILLE), KY. — Blackford Telephone Co. has incorporated with a capital of $1000 by A. F. Ray, Charles F. Poole and W. H. Bradley.

LOUISVILLE, KY. — Commercial department of the Louisville Gas & Electric Co., during the week ended Oct. 19, accepted 43 new electric light and power customers with 60 kw. of lighting and 62 hp. in motors. New business connected to the company's lines includes 27 customers with 9 kw. of lighting and 177 hp. in motors. There was a gain of 16.4 per cent in electrical energy output compared with the corresponding week last year.

MANNINGTON, KY. — Memphis Coal Mining Co. plans to build a power house and two electrically equipped coal tipples and the installation of number of large motors.

BIRMINGHAM, ALA. — Alabama Power Co., furnishing light and power to northern Alabama, including Birmingham, will make additions and improvements in its system. Address general manager.

LITTLE ROCK, ARK.—The city is considering enlargement of its electric light plant to supply commercial lighting. Address H. Levinson, city engineer.

WYNNE, ARK.—The electric light plant is to be improved and new machinery installed at a cost of $25,000.

NEW ORLEANS, LA.—Crescent Stock Yard & Slaughter House Co. has under consideration the rebuilding of its two cooling plants, machine shop and shipping shed, recently destroyed by fire, entailing a loss of about $200,000.

EL RENO, OKLA.—The El Reno Mill has applied to the Oklahoma Gas & Electric Co. for an additional 100 hp. in motors.

OKLAHOMA CITY, OKLA.—Morris Packing Co. has applied to the Oklahoma Gas & Electric Co. for additional electrical energy amounting to approximately 500 kw., to take care of additional machinery being installed at their plant.

SULPHUR, OKLA.—Plans are being made for a new power house at the pumping station.

GRANBURY, TEX.—R. A. Grunby is having plans prepared for the reconstruction of the electric light and power plant recently destroyed by fire with loss estimated at $20,000.

McKINNEY, TEX.—Texas Electric Railway Co. has bought land and will enlarge trackage at McKinney for express traffic. Burr Martin, Dallas, Tex., general manager.

SAN ANGELO, TEX.—Permission to install and operate an electric light and power plant in the St. Angelus Hotel was granted to C. C. McBurnett, Oct. 19 by the city commission. The system will cost about $12,000 and will be of sufficient capacity to furnish current for the business houses in the same blocks.

WESTERN STATES.

COEUR D'ALENE, IDA.—Steam as a motive power in the Northern Pacific yards is being replaced by electricity within the city limits.

DAVENPORT, WASH.—Intermountain Power Co. has been granted a franchise to erect an electric transmission line from Long Lake southward through Lincoln to a connection with the Milwaukee Railway in Adams county.

SEATTLE, WASH.—Skinner & Eddy Shipbuilding Corporation has been granted a permit for the construction of a power house at 1201 Railroad avenue south, to cost about $20,000.

SEATTLE, WASH.—It is proposed by the City Utilities Committee that lighting plant bonds amounting to $1,750,000 be issued. and application to Capital Issues Committee for approval will be made. The funds thus to be raised are for construction and extensions in the lighting department, and to retire $800,000 in warrants; also to construct a waterfront substation at Ballard, and to pay costs of interconnecting with the system of Puget Sound Traction, Light & Power Co.

TACOMA, WASH.—Todd Dry Dock & Construction Co. has given the contract for erecting 100 houses in Capital Heights. The council will make all necessary improvements in the way of sewers and electric lighting.

MARSHFIELD, ORE.—The plant of the E. Johnson Lumber Co., recently destroyed by fire, has been rebuilt. The plant will start to operate with 75 hp. in motors supplied by the Mountain States Power Co., which will very soon be increased to 150 hp. The Stika Spruce Co. at Coquille will be supplied an additional 150 hp., and will require 175 hp. more as soon as the planing mill now under construction is finished.

BUTTE CITY, CAL.—Great Western Canal Co. will build a power plant to develop 500,000 hp.

SACRAMENTO, CAL.—All bids submitted for equipment for an electrically driven pumping unit at the city waterworks station have been rejected by the City Council.

SAN DIEGO, CAL.—In connection with the construction of the proposed new marine brigade post on Dutch Flats, by the Government, arrangements have been completed for the installation of an electric lighting system.

CANADA.

VANCOUVER, B. C.—Tudhope Electric Metals Co. has awarded a contract for the construction of an electric foundry to the Cotton Co., Ltd.

ROSTHERN, SASK.—The Water Commissioners have under advisement the installation of additional electrical equipment at the power house for lighting purposes.

NEW PUBLICATIONS

LOW-RATE COMBUSTION IN FUEL BEDS OF HAND-FIRED FURNACES is the title of Technical Paper 139 recently issued by the Bureau of Mines and prepared by Henry Kreisinger, C. E. Augustine and S. H. Katz. This paper presents the results of a study of the processes of combustion in the fuel beds of hand-fired furnaces when burning coal at such low rates of combustion as are used in house-heating apparatus. The study is an extension of the work reported in Technical Paper 137a which covers the higher rates of combustion, such as are used in burning coal under power plant and locomotive boilers. That report deals with rates of combustion of 20 to 180 pounds of coal per square foot of grate per hour, whereas this paper covers the rates below 20 pounds, and describes the most important features of the experiments made.

BOILER AND FURNACE TESTING.—The Bureau of Conservation of the United States Fuel Administration, Washington, D. C., has issued Engineering Bulletin No. 1, entitled "Boiler and Furnace Testing," prepared by Rufus T. Strohm, which treats in a clear and concise manner with the essential elements of boiler and furnace testing. In this bulletin the Fuel Administration recommends that every boiler plant have some means of daily checking the efficiency of the boiler and furnace, and states that the simplest and best way of determining the efficiency of the boiler is to make an evaporation test, such as described in this publication. Numerous suggestions as to how the efficiency of the boiler may be increased and coal saved are conveniently grouped in this valuable bulletin.

PROPOSALS

COPPER WIRE AND CABLE, ETC.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 6, for furnishing, under Circular No. 1234, copper wire and cable, conduit, laboratory instruments and electrical supplies and fixtures. For further information address the above office.

INCORPORATIONS

AUBURN, WASH.—Auburn Battery & Electric Co. has incorporated with a capitalization placed at $5,000. Incorporators: F. M. Russell, C. C. Hayes and A. F. Anderson.

LANCASTER, WIS.—Interstate Power Co. was recently incorporated with a capital of $1,000,000. The purpose of the company is to produce, transmit and sell electric energy for light, heat and power in Wisconsin and Iowa, especially in Grant, Crawford and Richland counties, Wisconsin; and Clayton, Fayette, Buchanan, Allamakee and Winneshiek counties, Iowa.

JANESVILLE, WIS.—Articles of incorporation have been filed by the Porter Electric Line Co., which will furnish power to the farmers in the vicinity of Porter and Evansville. The capital stock of the company is given as $6,000. The incorporators are Joseph E. Porter, F. F. Miller and J. K. Porter.

NEW YORK, N. Y.—Electric Transport Co. Capital $100,000. To construct and equip electric underground carrying systems. R. Sugden, N. C. Norris, and W. A. Anderson, 165 Broadway, are the incorporators.

NEW YORK, N. Y.—Process Engineers, Inc. Capital $200,000. To engage in a general electrical engineering capacity. Incorporators: J. A. Kellogg, H. J. Alheim, and E. Ackley, 15 Broad street, New York.

BALTIMORE, MD.—Modern Way Co. Capital $10,000. To install heating plants, etc. Incorporators: Claude Hughes, Hyman Amernick, and R. L. Webb.

CHAMBLEE, GA.—Chamblee Light & Power Co. has been incorporated with a capital stock of $3,000, by M. Mauck and A. J. Morris.

CONDE, S. DAK.—Electric Distributing Co. has incorporated with a capital of $50,000 by L. C. Van Ornum, H. J. Plade and Emil Baretech.

COVINGTON, KY.—Wadsworth Electric Manufacturing Company, with a capital of $100,000, has incorporated to engage in the manufacture of electrical supplies. Incorporators: George Wadsworth, Harry W. Percival and Alfred Allen.

LOUISVILLE, KY.—Louisville Storage Battery Company. Capital, $15,000. To manufacture storage batteries. Incorporators: W. G. and A. G. Heist, and Walter Huffaker.

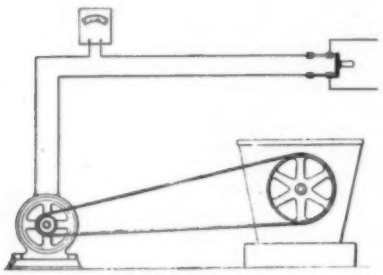
Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Dynamo (1,278,865).—Besides providing a set of fan blades for directing a cooling current of air through parts of the motor, James F. Curtis (of Pitcairn, Pa.) secures an oil-throwing ring to these fan blades and uses this ring for expelling the excess of lubricating material.

Mixing Dough (1,219,143).—To insure a uniform stiffness or consistency of dough, regardless of the degree of fineness to which the flour and other ingredients have been ground, Curtis J. Patterson (of Kansas City, Kans.)



No. 1,279,143.—Dough-Mixing Indicator.

judges of the stiffness by the resistance which it offers to the mixing machine. That is to say, he drives his mixer by an electric motor and watches the ammeter in the supply circuit, adding either flour or water according as the ammeter reads above or below a given amount.

Electrode for Bleaching Apparatus (1,279,192).—In using a carbon electrode mounted on a metal stud, Frank G. Wheeler (of Appleton, Wis.) makes the portion of the carbon adjacent to the metal impervious to the electrolyte and to the decomposition products of the latter. For this purpose he impregnates that part of the carbon with a mixture containing asphaltum and a glycerid.

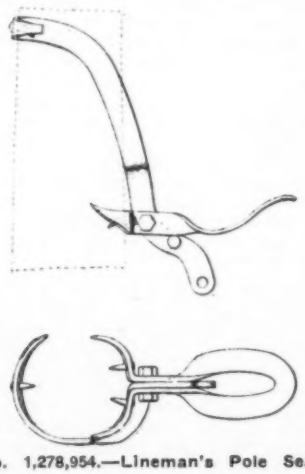
Arc-Welding Mechanism (1,278,982).—A welding strip is fed to the arc by a motor-driven mechanism, the current generator and the feeding mechanism being both driven by a source of power which is responsive in its speed to the changes in the amperage of the arc. Patent assigned by Harry D. Morton, of Detroit, to the Automatic Arc Welding Co. of that city.

Polyphase Generator with Tuned Spark Gap. (1,279,009).—Condensers and regulatable self-induction coils are so arranged in connection with a spark-gap mechanism and a polyphase generator that the discharges of each condenser on each phase are produced at the moment when the intensity of the charging current passes through zero. Patented by Lucien Rouzet, of Paris, France.

Suction Fan (1,278,852).—In this patent Francis M. Case (of Cleveland, Ohio) describes a collar arranged for warding from the bearing of an electric motor the counter air currents produced by a suction fan.

Pulsating-Current Motor (1,278,924).—In the motor designed by Rudolph E. Hellmund (of Swissvale, Pa.) for use on a pulsating current, damping grids are embedded at the base of the field poles for forcing flux pulsations through the laminated portion of a magnetic yoke, while permitting a constant magnetic flux through a solid portion of the same yoke.

Lineman's Post Saddle (1,278,954).—For linemen's use, William G. Looney (of Deskins, Va.) mounts a seat on a lever which terminates in prongs adapted to dig into the nearer side of a pole. This lever is pivoted to an arm which reaches around the



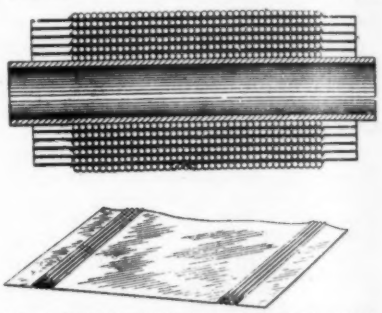
No. 1,278,954.—Lineman's Pole Seat.

farther right side of the pole and which also has a prong to prevent it from slipping on the pole.

Battery Plate Separator (1,279,074).—To space the plates of storage batteries from each other, Frank T. Baird (of Blue Island, Ill.) uses slabs or sheets sawed out of tripoli in its native state.

Air Heaters and Cook Stoves (1,279,363—1,279,364).—Novel details of construction are shown in these two patents, both assigned by Frank Kuhn and Jay A. Hand (of Detroit) to the American Electrical Heater Co.

Making Electrical Coils (1,278,993).—In winding coils in which the successive layers are insulated by paper sheets placed between them, the wire is apt to slip along the paper, particularly at the ends of the coil. To prevent this, Edward F. Parks (of Providence, R. I.) first forms creases



No. 1,278,993.—Coil Insulation and Winding Retainer.

in the paper, so spaced as to catch one or more of the end turns when the paper is in position. His patent (which was assigned to the Universal Winding Co. of Boston), also shows a winding mechanism arranged for automatically creasing the paper while the latter is fed into position.

Electric Heating Furnace (1,279,313).—In the furnace designed by Herman V. Finnie (of St. Catharines, Ont., Canada) the articles to be heated are placed in a tube which forms the secondary of a transformer. The patent was assigned to the Canadian Crocker-Wheeler Co., Ltd., of the same city.

Secondary Battery Cell (1,279,280).—Henry Csanyi (of New York City) uses red lead and ammonium chloride in the depolarizer, and the chlorides of both ammonium and zinc in the electrolyte. On charging the battery, zinc is deposited at the negative electrode, and chlorine is released to form lead chlorid with the red lead, the original combinations being restored during the discharging of the battery.

Electric Soldering Iron (1,279,321).—The heating element used by Benjamin F. Gardner of Chicago for a soldering iron consists of a tubular section of resistance material abutting against the tip of the iron, and a hollow spool of wire back of the resistance tube and in series with it. The tubular resistance has a negative temperature coefficient, while the wire on the spool has a positive temperature coefficient.

Men in Service

William D. Ray Commissioned Major in Quartermaster's Corps—G. H. Porter Receives Commission—Service Flags

HENRY A. DAVIS, formerly of the electric motor department of the Rochester Railway & Light Co., Rochester, N. Y., was recently commissioned a second lieutenant in the Signal Corps.

PAUL A. DRUMMOND, 29th Engineers, Company A, formerly of the Cutler-Hammer Manufacturing Co., has been promoted to second lieutenant, U. S. Engineers, by recommendation of General Pershing.

J. CULVER, formerly welder in the clutch and magnet shop of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has been promoted to sergeant in the Aero Squad A, Carlstrom Field, Arcadia, Fla.

LOUIS D. GIBBS, superintendent of the advertising department of the Boston Edison Co., has been given a leave of absence to become associated with the statistical division of the War Industries Board.

LEON B. JONES, assistant chief engineer of the gas department of the Pacific Gas & Electric Co., has enlisted in the Engineer Corps of the United States Army, and is now located at the engineer officers' training camp at Camp Humphreys, Virginia.

CAPT. ANGUS S. HIBBARD, for 18 years vice-president and general manager of the Chicago Telephone Co., is now in France reorganizing the American Red Cross telephone system. The American Red Cross has found it necessary to furnish a complete telephone system for its work abroad.

CAPT. R. H. HASTAIN, formerly connected with the sales department of the Mid-West Electric Co., Omaha, Neb., is now in France with the 317th Field Signal Battery, 76th Division. Prior to 1909 Captain Hastain was in service in the Philippines, and after returning to the United States he entered the sales department of the Dean Electric Co.

HARRY B. JOYCE, who prior to his enlistment in Government service was power engineer for the United Electric Co. of New York City, was recently commissioned a captain in the Quartermaster's Corps, U. S. A. Captain Joyce's experience covers practically every phase of electric lightin, and this, together with his special knowledge of refrigeration, led to his recent appointment.

CAPT. A. S. COMBS, Signal Corps Reserve, has returned to this country detailed for special duty. Captain Combs was in the fighting around Amiens while brigaded with New Zealand troops, and with his company participated in wiping out the St. Mihiel sector. Prior to entering the Signal Corps about a year ago, Captain Combs was connected with the engineering department of the Automatic Electric Co., Chicago.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

SERGEANT GEORGE J. MCKENZIE of the 102d Machine Gun Company, who, before entering the army, was a cable splicer in the Salem district of the New England Telephone & Telegraph Co., and who was seriously wounded in April, has been cited in general orders for heroism at the battle of Seicheprey.

E. B. HOOKS, JR., superintendent of high tension construction of the Georgia Railway & Power Co., Atlanta, Ga., has been called into Government service as electrical expert. Mr. Hook will go to Galveston, Tex., to take charge of building a transmission line and distribution system for the new United States naval air station at Galveston Bay.

NEW ENGLAND TELEPHONE & TELEGRAPH CO., Manchester, N. H., recently raised a beautiful 95-star service flag, in honor of that number of its employes who have enlisted in the fight for democracy. Two of the stars were gold in memory of John Humiston, former operator at East Jaffrey and Hanover, who was killed in action, and Arthur W. Morse, fireman on the U. S. transport Mount Vernon, who lost his life when that ship was torpedoed Sept. 15.

The service flag of the BUREAU OF ELECTRICAL INSPECTION OF CHICAGO now contains eight stars, representing the following former employes in service: Maj. Samuel Todd, Lieut. F. C. Kobfeldt, Sergt. Arthur W. Barwig, Sergt. Frank A. Walsh, Sergt. A. J. Walsh, F. W. Derby, Warren E. Bostwick and J. B. Ryan. In addition to these men in active service, the following men have recently been appointed material inspectors in the Signal Corps: George C. O'Brien, Roy Burgess, James D. O'Reilly, George A. Burnham, Lee J. Johnson and Edward J. McGann.

SAMUEL C. SHAFFNER, Chicago, Ill., a well known gas and electrical engineer, who has for the past year or two been working with Thomas A. Edison on Government submarine inventions, was recently commissioned a captain in the quartermaster's corps.

E. P. PECK, superintendent of operation of the Georgia Railway & Power Co., Atlanta, Ga., has joined the Bureau of Standards at Washington, D. C. Mr. Peck, who has had charge of the standardizing laboratory and the precision instruments of the company, will for the present assist in the standardization work being done in connection with the purchase of electrical equipment and supplies for the War Department.

GEORGE H. PORTER, district sales manager, railway department of the Western Electric Co., has been commissioned a captain in the Signal Corps and expects to sail for France soon. He was captain of Company I, 1st regiment, Illinois National Guard, and was called to Washington Oct. 2. Captain Porter is well known in electrical circles; he is a member of the Electric Club-Jovian League, and president of the Illinois Athletic Club.

WILLIAM D. RAY, formerly vice-president and general manager of the Pennsylvania Utility Co., Easton, Pa., was recently commissioned a major in the Quartermaster's Corps, Construction Division. Major Ray will be a utility officer at one of the cantonments, where he will have charge of the lighting and other utility services. He has an extensive experience in the electrical field, having begun his career in 1887 as wireman and station attendant with the Cicero Water, Gas & Electric Light Co., Oak Park, Ill. In the following year he became electrician with the Chicago & Northern Pacific Railroad Co. at Chicago. After three years' service with that company he became connected with the Standard Electric Co. of Chicago as assistant consulting electrician and in 1893 accepted a position in the electrical department of the Chicago World's Fair, remaining until the following year, when he became general manager and superintendent of the Everett Railway & Electric Co., Everett, Wash. He resigned this position in 1897 to become sales engineer of the Lorain Steel Co.'s Chicago office in the sale of railway material. He later became associated with the Woods Motor Vehicle Co. as assistant electrical engineer, and subsequently served the C. P. Magoon Air Brake Co. as general manager; Detroit Construction Co. as electrical engineer; Westinghouse Traction Brake Co. as sales representative. From 1908 to 1910 he held the position of contract agent in the electrical department of the Sanitary District of Chicago, from which he resigned to become vice-president and general manager for the Northern Indiana Electric Co. In 1915 he joined the gas and electric light utilities of Easton, Pa., as vice-president and general manager.

Personal

J. G. Mitchell Appointed Telephone Engineer of State Utility Commission — Charles A. Stanley Promoted — Changes

E. J. HEINEN has severed his connection with the Strong & Scott Co., Minneapolis, Minn., to become efficiency engineer of the Minneapolis General Electric Co.

RIECE RIDGELY has joined the Arkansas Valley Railway, Light & Power Co. at Ordway in the capacity of superintendent, succeeding H. H. Lyons, now in Government service.

ROBERT E. BOND, president of the Island Electric Co., Ltd., Wailuku, Maui, T. H., has been appointed secretary of the Baker-Joslyn Co., with headquarters in San Francisco, Cal.

W. D. APPEL, formerly motor engineer of the Steel Products Co., Cleveland, is now in the engineering department of the Curtiss Engineering Corp., Garden City, Long Island, N. Y.

J. A. FRITZ has resigned his position as chief engineer of the Scranton (Pa.) Electric Co.'s power plants to become works engineer for the Penn-Seaboard Steel Corporation, of Chester, Pa.

W. G. GORDON, formerly connected with the Railway & Power Engineering Corp. and Malm, Gordon & Co., has returned to the Canadian General Electric Co., as transportation engineer.

J. M. ATKINSON, resident manager for the Big Horn Light & Power Co., Worland, Wyo., has resigned to become manager of the Missouri Valley Light & Power Co. at El Dorado Springs, Mo.

R. A. SARA, sales manager of the City of Winnipeg Light and Power Department, has resigned to accept a position with the American Cellulose & Chemical Manufacturing Co., of New York.

FRANK SAWFORD, until recently chief engineer of electrical and mechanical operations, Canadian Collieries, Union Bay, B. C., Canada, has become affiliated with the Taylor Engineering Co., Ltd., Vancouver, B. C.

P. D. WAGONER, for a number of years president and general manager of the General Vehicle Co., Long Island City, N. Y., has become associated with the Elliott Fisher Co., Harrisburg, Pa., in the capacity of president.

W. D. HART, formerly district superintendent of the Illinois Northern Utilities Co., Belvidere, Ill., was recently appointed general contract agent for the Illinois Northern Utilities Co., at Dixon, Ill., succeeding D. C. Yontz, resigned.

A. W. CHILDS, superintendent of sales for the Southern California Edison Co., was recently elected a member of the advisory committee of the California Co-operative Electrical Campaign, succeeding G. B. McLean, who resigned.

A. D. MCMULLEN has resigned as general manager of the Capitol Electric Co., Salt Lake City, Utah, to become president of the Motor Mercantile Co., of that city. The latter company handles exclusively wholesale automobile accessories, as well as electric supplies.

A. L. SMITH of the engineering department of the Georgia Railway & Power Co., Atlanta, Ga., has been promoted from general construction foreman to superintendent of the construction section.

CHARLES A. STANLEY, for the past few years commercial engineer for the Kansas Gas & Electric Co., Wichita, Kans., has been promoted to the position of general superintendent and will have charge of the detail operation of the company.

J. F. WESSEL has been appointed chief engineer of the United Gas & Electric Engineering Corp., New York, succeeding L. J. Hirt, resigned. Mr. Wessel assumes this title and these duties in addition to his responsibilities as vice-president of the corporation in charge of the operation of the northern properties.

HARRY A. NICHOL, general manager of the Union Traction Company of the Union Traction of Indiana, has gone to Hampton Roads, Va., where he will become a federal manager of transportation of the Hampton district, including Newport News, Old Point Comfort, and Norfolk. He will have general supervision of two electric railroads, ferry lines and terminals. Leave of absence has been granted him during the war by the Union Traction Company, of which he has been general manager for the last thirteen years.

JAY G. MITCHELL, who for some time has been associated with the Frank B. Cook Co., Chicago, as sales manager and engineer, was recently appointed telephone engineer of the Illinois Public Utilities Commission, of Springfield, Ill. Prior to his connection with the Frank B. Cook Co., Mr. Mitchell was for several years engaged in consulting engineering work with McMeen & Miller, during which period he paid considerable attention to valuation problems. Mr. Mitchell's operating experience dates back to 1893, with the Cleveland Telephone Co., in Cleveland, Ohio, and intervening years were occupied with manufacturing and sales work with the North Electric Co., the Dean Electric Co. and the Telephone Improvement Co.

Obituary.

WALLACE B. LINDSAY, head of the electrical engineering department of Ingersoll, Rand & Co., Phillipsburg, N. J., died recently of pneumonia at his home, 600 West One Hundred and Thirty-sixth street, New York.

FRANK I. PARKER, of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., died at his home in Milwaukee on Oct. 18, at the age of 36 years. His death was due to pneumonia contracted through Spanish influenza. Mr. Parker was graduated from the University of Wisconsin in June, 1906, and in July became engineer in charge of production in the magnet and clutch department of the Cutler-Hammer Co. His early work was with lifting magnets made by this company, being responsible for many of the exclusive features of these magnets as well as designing several of its magnet and motor-operated brakes. Since 1911, Mr. Parker has had charge of sales service work on clutch department products. He was made an associate member of the American Institute of Electric Engineers in 1910 and in 1913 became a member. He is survived by his widow and one child.

LEONARD S. CAIRNS, general manager of the Eastern Pennsylvania Railways Co., died of pneumonia on Oct. 10, at Pottsville, Pa. He was 36 years of age. For a number of years Mr. Cairns was general superintendent of the Twin City Rapid Transit Co. of Minneapolis and St. Paul, Minn. In 1912 he resigned from the operating organization of that company to join the staff of the J. G. White Management Corporation, New York, N. Y., and was assigned to the position of assistant general manager of the Manila Electric Railroad & Light Company, Manila, P. I. He was promoted by the management corporation in 1917 to the office of general manager of the Eastern Pennsylvania Railways Co., Pottsville, Pa.

WILLARD E. CASE, of Auburn, N. Y., whose researches in the field of electricity won him recognition in scientific circles both in this country and abroad, died in that city on Oct. 27 at the age of 61 years. Mr. Case received his early education in the public schools, and then continued his academic studies under the guidance of a tutor. He subsequently was graduated from the Hamilton Law School and after a few years in law practice, he took up the study of electricity, electrochemistry and general physics. When he was 29 years old he was invited to read a paper before the Royal Society of London on the subject, "A New Means of Converting Heat Energy Into Electrical Energy," and proved his theory by means of a specially constructed battery of his own invention. From that time his reputation as an electrical experimenter was established and he appeared before a number of other scientific societies both here and in Europe. Among the important discoveries made by Mr. Case were the conservation of the power of the sun's rays and the transmission of black and white photography by wire in which he was assisted by his son, Theodore W. Case. In the past year Mr. Case directed his attention to war work and founded the New York Electrical Society for War Research Work. He was vice-president of the New York Electrical Society and a member of the American Institute of Electrical Engineers, American Electrochemical Society, American Society for the Advancement of Science, Royal Society of Arts, London; American Geographical Society, Metropolitan Club of New York, Lawyers' Club of New York, and a number of other organizations.

After the War, What ?

IX.

THE following extracts from an address by Mr. Rankin were printed in a pamphlet on "War—and War Time Advertising" issued by the Wm. H. Rankin Co., Monroe Bldg., Chicago. All of this pamphlet is profitable reading.

C. A. Tupper, President . CHICAGO
INTERNATIONAL TRADE PRESS, Inc.

When the Boys Come Back

During the past four years, no automobiles have been sold or offered for sale in Great Britain, yet the manufacturers of automobiles have continued their advertising unabated with the full approval of the Government, and their good will and standing with the buyers will be 100 per cent after the war, rather than, say 10 per cent if they had discontinued their advertising.

Advertisements are, in reality well informed sales people talking to you in print. Their language is carefully chosen and condensed—to tell you facts in as few words as possible. Very seldom does anyone advertise unless he has an unusually good product to offer. The cost of advertising automatically bars the unsuccessful.

So, read advertisements to keep posted as to what to buy and also to be informed why you cannot buy certain brands of goods because their manufacturers are devoting all of their time to building war products to help win the war.

Keep a warm spot in your heart for the goods no longer available on the dealer's shelves, because they, too, like our boys overseas, will "come back" after the war and renew old friendships. We want to be ready with our Victory Celebration and say "Welcome Home Again, Advertised Product—your company did good work for Uncle Sam and we are going to show our appreciation by buying even more of such products than before the War."

In that way the advertiser's good will will be maintained and he will draw dividends in increased sales after the war to make up for the loss of trade during the period of war.

WM. H. RANKIN.

Financial News

Stock Issue of Massachusetts Electric Approved.

The Board of Gas and Electric Light Commissioners has approved the issue by the Eastern Massachusetts Electric Co. at par value of $100 a share, 250 shares of new capital stock, and of 6 per cent bonds to the amount of $135,000 maturing July 1, 1933, the bonds to be part of a total issue of not exceeding $300,000, all equally secured by a first mortgage of the company's property and franchise. The proceeds of the sale of the new stock and bonds will be applied as follows: The proceeds of bonds of the face value of $130,000 to be applied to the payment of an equal amount of the company's promissory notes outstanding April 30, 1918, and the proceeds of the balance of the bonds and stock to the payment of the company's obligations outstanding on the same date incurred in the acquisition of its plant and property. On April 17, 1916, the board approved of an issue of original capital stock for this company to the amount of $125,000 on account of the erection of a high tension transmission line to connect the stations of the Malden Electric Co. and of the Suburban Gas & Electric Co. in Salem. The company applied for the approval of $48,200 new stock and $135,000 bonds.

Bay Point Light & Power to Issue Stock.

The Railroad Commission of California in a recent decision granted authority to the Bay Point Light & Power Corporation to issue $44,000 par value of stock to be sold at not less than $80 per share. The Commission was of the opinion that the money, property or labor to be procured or paid for by the issue of this stock is reasonably required to reimburse its treasury for income expended to finance capital expenditures and pay for the installation of additions and betterments to its plant and system. The proceeds obtained from the sale of the stock will be used as follows: $2,183.56 will be used to pay notes; $4,270.24 will be used to reimburse the treasury of the company because of earnings expended to finance capital expenditures prior to June 30, 1918, and the remainder of the proceeds will be used to finance in whole or in part the capital expenditures for additions and improvements.

Two New Utility Bond Offerings.

An additional block of $1,000,000 Alabama Power Co. first mortgage thirty-year 5 per cent bonds is being offered by the Harris Trust & Savings Bank. The bonds have been taken from escrow to pay for needed additions and improvements and have been favorably passed upon by the Capital Issue Committee as necessary financing. The bonds are due March 1, 1946, and are being offered at 85 and interest. The Alabama Power Co. furnishes electric light and power to northern Alabama, including the "Birmingham district."

The Harris Trust & Savings Bank, the Guaranty Trust Co. of New York, Bonbright & Co. and H. M. Byllesby & Co. have just purchased an additional block of Northern States Power Co. first and refunding mortgage 5 per cent bonds. The bonds, which are due April 1, 1941, have been taken from escrow to pay for needed additions and improvements following the approval of the financing by the Capital Issues Committee.

San Joaquin Light to Issue Bonds.

The Railroad Commission of California has authorized the San Joaquin Light & Power Corporation to issue $207,206.53 of Series "C" 6 per cent bonds for the purpose of financing its capital expenditures from July 1, 1918, to July 13, 1918, both dates inclusive.

Earnings.

BINGHAMTON LIGHT, HEAT & POWER COMPANY.

Statement of net income for the month of August, 1918:

Operating revenues	$34,682.69
Operating expenses, taxes and depreciation	23,022.88
Operating income	$11,659.81
Other income	1,984.08
Gross income	$13,643.89
Deductions from income	6,597.61
Net income	$ 7,046.28

NEW JERSEY POWER & LIGHT CO.

Statement of net income for the month of August, 1918:

Operating revenues	$25,415.58
Operating expenses and taxes	16,522.28
Operating income	$ 8,893.30
Other income	245.91
Gross income	$ 9,139.21
Deductions from income	6,290.52
Net income	$ 2,848.69

RUTLAND RAILWAY LIGHT & POWER SYSTEM.

Earning statement for September.

	1918.	1917.
Gross revenue, including other income	$50,923	$42,440
Operating expenses and taxes	27,700	24,580
Total income before deductions	$23,223	$17,860
9 Months Ending Sept. 30—	1918.	1917.
Operating revenue	$386,925	$348,146
Operating expenses and taxes	228,689	197,849
Operating income	$158,236	$150,297

PENNSYLVANIA UTILITIES SYSTEM.

Earning statement for September—

	1918.	1917.
Operating revenue	$133,494	$101,186
Operating expenses and taxes	95,797	89,315
Operating income	$ 37,697	$ 11,871
9 Months Ending Sept. 30—	1918.	1917.
Operating revenue	$1,150,630	$845,154
Operating expenses and taxes	854,702	698,917
Operating income	$ 295,928	$146,237

GENERAL GAS & ELECTRIC COMPANY.

(Subsidiary Companies.)

Statement of preliminary gross revenue for the month of September, 1918 and 1917, and comparison:

System—	1918.	1917.
Rutland	$ 49,205.29	$ 42,263.33
Northwestern Ohio	40,415.00	30,433.60
Sandusky	35,158.81	35,080.19
Binghamton	37,743.61	30,318.70
Sayre	10,416.58	8,285.35
New Jersey	27,030.16	18,564.03
Interurban Gas Co.	1,292.17	973.84
Totals	$201,261.62	$165,924.04

CLAREMONT POWER COMPANY AND AFFILIATED COMPANIES.

August—	1918.	1917.
Operating revenues	$ 36,244	$ 26,275
Operating expenses and taxes	25,832	20,202
Operating income	$ 10,412	$ 6,073
8 months ended August 31—	1918.	1917.
Operating revenues	$237,127	$191,309
Operating expenses and taxes	144,730	128,805
Operating income	$ 92,397	$ 62,504

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. Oct. 22.	Bid. Oct. 29.
Adirondack Electric Power of Glens Falls, common	6	12	12
Adirondack Electric Power of Glens Falls, preferred	6	..	..
American Gas & Electric of New York, common	10+extra	80	80
American Gas & Electric of New York, preferred	6	39	39
American Light & Traction of New York, common	..	235	225
American Light & Traction of New York, preferred	6	95	94
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	68	68
American Public Utilities of Grand Rapids, common	..	12	12
American Public Utilities of Grand Rapids, preferred	6	35	38
American Telephone & Telegraph of New York	..	196½	105
American Water Works & Elec. of New York, common	..	6	7½
American Water Works & Elec. of New York, particip	7	13	13
American Water Works & Elec. of New York, first preferred	..	61	63
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	18	18
Cities Service of New York, common	+extra	300	280
Cities Service of New York, preferred	6	76	75½
Commonwealth Edison of Chicago	8	109	109
Comm. Power, Railway & Light of Jackson, common	..	23	22½
Comm. Power, Railway & Light of Jackson, preferred	6	43	46
Federal Light & Traction of New York, common	..	7¼	7¼
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	50	50
Northern States Power of Chicago, common	..	52	52
Northern States Power of Chicago, preferred	ex.div.7	84	85
Pacific Gas & Electric of San Francisco, common	..	38	38
Pacific Gas & Electric of San Francisco, preferred	6	82	82
Public Service of Northern Illinois, Chicago, common	7	80	80
Public Service of Northern Illinois, Chicago, preferred	6	81	82
Republic Railway & Light of Youngstown, common	4	18	18
Republic Railway & Light of Youngstown, preferred	6	55	55
Standard Gas & Electric of Chicago, common	..	7½	7½
Standard Gas & Electric of Chicago, preferred	6	31	31
Tennessee Railway, Light & Power of Chattanooga, common	..	2	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	12	12
United Light & Railways of Grand Rapids, common	4	34	35
United Light & Railways of Grand Rapids, preferred	6	64	66
Western Power of San Francisco, common	..	11	14
Western Power of San Francisco, preferred	6	50	59
Western Union Telegraph of New York	extra	92	90
Industrials—			
Electric Storage of Philadelphia, common	4	54	53
General Electric of Schenectady	8	157	154
Westinghouse Electric & Mfg. of Pittsburgh, common	7	45	44½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	63	63